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ABSTRACT

In this research project, subject terms from the Dewey Decimal Classification (DDC) Schedules and Relative Index were incorporated into an online catalog as searcher's tools for subject access, browsing, and display. Four features of the DDC were employed to help searchers browse for and match their own subject terms with the online catalog's terminology: (1) subject terms in the DDC Schedules; (2) hierarchical arrays of related terms in the DDC Schedules; (3) subject terms in the DDC Relative Index; and (4) class numbers in the DDC Schedules and Relative Index. The effectiveness of the DDC in an online catalog was tested in online retrieval experiments with library patrons and staff at the Library of Congress, the New York State Library, the Public Library of Columbus and Franklin County (Ohio), and the Mathematics Library of the University of Illinois at Urbana-Champaign. The research findings chiefly address subject searchers' use of a library classification in the information retrieval environment of an online catalog. These findings provide insight into searchers' problems with online displays of the DDC Schedules and Relative Index, bibliographic record displays enhanced with subject information from the DDC, and online catalog capabilities necessary to support searching, displaying, and retrieving library cataloging and classification information. As a research project studying online catalog use, the DDC Online Project furthers general knowledge of library patron use of online catalogs, regardless of the extent to which these catalogs have been enhanced by a library classification. (Author/THC)

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Final Report to the Council on Library Resources

Dewey Decimal Classification Online Project: Evaluation of a Library Schedule and Index Integrated into the Subject Searching Capabilities of an Online Catalog

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Abstract

The Dewey Decimal Classification (DDC) Online Project was supported by the Council on Library Resources, OCLC, and Forest Press (publisher of the DDC). In the research project, subject-rich terms from the DDC Schedules and Relative Index are incorporated into an online catalog as searchers' tools for subject access, browsing, and display. The machine-readable DDC used in this project was converted from the print tapes that originally served to produce the nineteenth edition of the printed DDC using computerized photocomposition.

Four features of the DDC are employed to help searchers browse for and match their own subject terms with the online catalog's terminology: (1) subject terms in the DDC Schedules (e.g., headings, scope notes, class here notes, including notes), (2) hierarchical arrays of related terms in the DDC Schedules, (3) subject terms in the DDC Relative Index, and (4) class numbers in the DDC Schedules and Relative Index. Using the expanded subject information from these sources, users of the experimental online catalog have a greater chance of finding exactly the topic they are seeking.

The effectiveness of the DDC in an online catalog was tested in online retrieval experiments with library patrons and staff at the Library of Congress, the New York State Library, the Public Library of Columbus and Franklin County (Ohio), and the Mathematics Library of the University of Illinois at Urbana-Champaign. The online retrieval tests provided data and analyses to answer the following three research questions:

1. Is the machine-readable DDC suitable to implement in an online catalog as a searcher's tool for subject access, browsing, and display?

2. When used as a searcher's tool for subject access, browsing, and display, does the online DDC improve the search performance of subject searchers at the online catalog?

3. Do subject searchers prefer an online catalog in which the DDC is available as a searcher's tool to an online catalog without online DDC?

These research findings address the interests of the project participants involved in the construction and maintenance of the DDC, viz., Forest Press and the Decimal Classification Division of the Library of Congress, library administrators involved in decision making about enhancements to a library's online catalog, and library staff and technical systems staff involved in the design and implementation of an online catalog, in general, and, specifically, of a library classification in an online catalog.

The research findings of the DDC Online Project chiefly address subject searchers' use of a library classification in the information retrieval environment of an online catalog. These findings provide insight into searchers' problems with online displays of the DDC Schedules and Relative Index, bibliographic record displays enhanced with subject information from the DDC, and online catalog capabilities necessary to support searching, displaying, and retrieving library cataloging and classification information. As a research project studying online catalog use, the DDC Online Project furthers our general knowledge of library patron use of online catalogs, regardless of the extent to which these catalogs have been enhanced by a library classification.

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OCLC and Forest Press worked together to obtain the participation of four libraries in the research project. The four participating libraries--Library of Congress, New York State Library, Public Library of Columbus and Franklin County (Ohio), and University of Illinois at Urbana-Champaign--contributed to every phase of the project. The following individuals participated in a working group to determine the strategies for searching and displaying the DDC in the experimental online catalogs developed for the project and monitored and reviewed these catalogs' functionality and interface throughout the development process: John Comaromi and Julianne Beall, Decimal Classification Division, and Margaret Morrison, General Reading Rooms Division, of the Library of Congress (LC); Peter Paulson and Barbara Lockett of the New York State Library (NYSL); Richard Palmer of the Public Library of Columbus and Franklin County (PLCFC); and Arnold Wajenberg of the University of Illinois at Urbana-Champaign (UI). Jo Calk (LC), John Meierhoffer (NYSL), Larry Black (PLCFC), and William H. Mischo (UI) provided the DDC Online Project team with bibliographic records in MARC format and in the selected area(s) of the DDC chosen by their respective

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In American libraries, library catalog users have benefited from nearly one hundred years of library practice and application of subject headings, which are the chief source of subject information about the library's collection. Classification has been chiefly visible to library users as a device for shelf arrangement and browsing of library materials. Thus, the integration of a library classification into the subject searching features of an online catalog is a new approach to the retrieval of subject information in the library catalog.

With this in mind, we are fortunate that John A. Humphry, Executive Director of Forest Press, had the courage and vision to consider support of a research project to study the DDC in an online catalog. We appreciate the encouragement of Mr. Humphry and his successor at Forest Press, Peter Paulson, who supported this study of the performance of an experimental online catalog in which the DDC has been incorporated as an online catalog searcher's tool for subject access, browsing, and display. By supporting this research on subject searching in online catalogs, Forest Press is indeed a pioneer in the study and enhancement of online catalogs. Forest Press has provided us with the opportunity to study subject searching in our attempt to improve existing online catalogs by enhancing subject access and providing possibilities for new search strategies that were not feasible through the alphabetical approach of subject headings and/or keywords presently supported in online catalogs.

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Executive Summary

1. Background and Project Objectives (Chapters 1 and 2)

In the Dewey Decimal Classification (DDC) Online Project, the DDC was studied as a searcher's tool for subject access, browsing, and display in an online catalog. The incorporation of the DDC into the information retrieval environment of an online catalog introduced the classed approach to online subject searching of library collections and provided possibilities for search strategies not feasible through the alphabetical approach of subject headings and/or keywords presently supported by online catalogs.

Mechanization of classification schedules for information retrieval purposes was first carried out by Freeman and Atherton (1968b) in their study of the Universal Decimal Classification (UDC) as an entry vocabulary in an online bibliographic system. At the time of their study, there were few (if any) operational online retrieval systems available to library patrons. After a thirteen-year hiatus, interest in classification as a subject searcher's tool in online bibliographic systems was rekindled: in late 1981, the preliminary findings of the Council on Library Resources-sponsored Online Catalog Project demonstrated library patrons' ability to use online catalogs to find library materials of interest, their acceptance of this new form of the library catalog, and their needs for improved subject access in online catalogs (chapter 2).

The realization that the printed 19th edition of the DDC was produced by computerized photocomposition prompted the OCLC Office of Research to ask Forest Press about the availability, for research purposes, of the print tapes used to produce this 19th edition. With the eventual support of Forest Press, the Council on Library Resources, and OCLC, the DDC Online Project team in the OCLC Office of Research obtained selected portions of a machine-readable DDC from Inforonics, Inc., that was converted from the print tapes, which originally served to produce the 19th edition of the printed DDC using computerized photocomposition.

The objectives of this project were the following (chapter 1):

1. Use the consensus of DDC experts to determine strategies for searching and displaying the DDC in an experimental online catalog.
2. Demonstrate the DDC as a searcher's tool for subject access, browsing, and display in the experimental online catalog.
3. Test the effectiveness of the DDC as a searcher's tool in this catalog.

4. Evaluate the demonstration and test results of the DDC as a searcher's tool and disseminate the results of the research project.

The research questions addressed in the DDC Online Project were the following (chapter 1):

1. Is the DDC online, produced by Inforonics, suitable to implement in an online catalog as an online searcher's tool for subject access, browsing, and display?

2. When used as a searcher's tool for subject access, browsing, and display, does the DDC online improve the search performance of subject searchers at the library catalog?

3. Do subject searchers prefer an online public access catalog in which the DDC is available as a searcher's tool to an OPAC without the DDC online?

2. Designing the Experimental Online Catalog (Chapter 3)

The DDC Online Project began with design work on the experimental online catalog. The experimental online catalog was actually composed of two online catalogs: (1) the Dewey Online Catalog (DOC), in which the Dewey Decimal Classification had been incorporated as a searcher's tool for subject access, browsing, and display and (2) the Subject Online Catalog (SOC), in which the DDC had not been incorporated. Throughout the project, the DDC Online Project team obtained comments from representatives of the four participating libraries, i.e., Library of Congress (LC), New York State Library (NYSL), Public Library of Columbus and Franklin County (PLCFC), and University of Illinois at Urbana-Champaign (UI), Forest Press staff, Decimal Classification Division (DCD) staff, project consultants, and interested OCLC staff regarding the design, indexing, and functionality of the experimental online catalog. Their involvement in the design process was initiated in a January 1984 meeting of all project participants to resolve (through consensus) issues concerning the indexing and display of the DDC in the experimental online catalog (section 3.2) and strategies for searching the DDC in this catalog (section 3.3). The meeting resulted in (1) the design of an experimental online catalog enhanced with the DDC Relative Index and Schedules in the four classification areas selected for study by the participating libraries and (2) subject searching strategies that featured the alphabetical, class number, keyword, and classed approaches.

The DDC Online Project team was unable to carry out all the design recommendations in the development of the experimental online catalog. The DDC Tables were excluded from the catalog because of the absence of special coding in class number fields of bibliographic records to identify Table references in built DDC class numbers. The modification of previous search results through explicit Boolean operations was not permitted in the experimental online catalog because of space limitations in the LSI-11 microcomputer used to develop the catalog. Design recommendations that were implemented in the experimental online catalog are discussed in section 3.4 of this report. The reasons for the team's decision not to implement certain recommendations are also covered in section 3.4 and appendix G.

3. Developing the Experimental Online Catalog (Chapters 4 and 5)

The databases of the experimental online catalog were created from three data sources: (1) machine-readable cataloging (MARC) records from the four participating libraries in selected subject areas of the DDC, (2) the 19th edition of the DDC Schedules, and (3) the Relative Index. Each participating library contributed between 8,000 and 15,000 MARC records in a subject area(s) selected by the library:

1. LC: Economics (330-339), commerce (380-382), and management (658)
2. NYSL: New York State geography (917.47-917.4799), United States colonial history (973.1-973.2), and New York State history (974.7-974.799)
3. PLCFC: Sports, recreation, and performing arts (790-799)
4. UI: Mathematics (510-519)

The DDC Online Project team selected fields from libraries' MARC records and the machine-readable DDC Schedules and Relative Index for the experimental online catalog. With regard to the DDC, subject-rich fields (such as class number captions, including, and example notes) were selected for the experimental online catalog; classifier's notes and footnotes were not processed into the experimental online catalog because these notes would not have been helpful to library patrons and staff performing subject searches.

Subject-rich fields in DDC Schedules and Relative Index records were manipulated by the project team to produce essential and desired information for the Dewey Online Catalog (DOC) (section 4.3). Special handling had to be given to DDC Schedules and Relative Index data to make this information more presentable, accessible, and understandable to online catalog subject searchers. For example, a range of DDC class numbers was expanded to individual Schedule records, each bearing a unique class number in the range and the same DDC caption and notes; dummy DDC class numbers with trailing zeros and captions had to be created in DOC to enable subject searchers to browse Schedule numbers with embedded zeros and their associated captions and notes.

Data in bibliographic records were processed into SOC and DOC (section 4.4). Fields and subfields of the MARC format record were selected for indexing and display in SOC (table 5) and DOC (table 6). In DOC, special handling was given to a number of fields, the most important of which was the creation of a Schedules DDC class number. Once created and added to the bibliographic record, this Schedules DDC class number allowed DOC to automatically match class numbers in libraries' bibliographic records with class numbers in the DDC Schedules and Relative Index to add subject-rich information from the Schedules and Relative Index to DOC bibliographic records. SOC and DOC bibliographic records contained the same information, but the DOC records were enhanced with subject-rich captions and notes from the DDC Schedules and Relative Index. Although DOC records were enhanced with the DDC, only Schedule captions (of the DDC information added to records) were displayed in bibliographic records (for the reasons described in section 5.6.3).

The functionality and operation of the experimental online catalog are detailed in chapter 5. In the project, there were four Subject Online Catalogs and four Dewey Online Catalogs, i.e., one for each of the four participating libraries. We wanted first-time users of SOC and DOC to be able to search these catalogs with ease and find items relevant to their topics of interest, since most searchers in the library patron and staff retrieval tests would be using the experimental online catalog for the first time. Therefore, the experimental online catalog was a menu-based system, which we felt was an appropriate interface for first-time users.

SOC had the traditional subject searching capabilities of online catalogs, namely subject heading, subject heading and title keyword, and class number searching (section 5.2). An overview of SOC subject searching is provided in table A.

Table A. SOC Subject Searching Capabilities

SOC Option Code	Functional Description	Source of Subject Terms for Indexing	Wisest Subsequent User Action(s)
SA	Search for subject and browse an alphabetical list of subjects near your subject (section 5.2.1)	Assigned subject headings from the library's bibliographic records	Browse backward or forward (BB or BF option) or select a listed subject heading to display retrieved items (SL option)
SD	Search directly for subject and retrieve number of items on your subject (section 5.2.2)	Keyword, implicit Boolean AND search of title, subject heading, series, and notes words in bibliographic records	Display retrieved items (DI option)
SC	Search directly for call number and retrieve number of items with your call number (section 5.2.3)	Class numbers created from class number subfield of the library's bibliographic records	Display retrieved items (DI option)

DOC had both the traditional subject searching capabilities of SOC and enhanced subject searching capabilities, because the DDC Schedules and Relative Index had been incorporated in DOC. An overview of DOC subject searching is provided in table B.

Table B. DOC Subject Searching Capabilities

DOC Option Code	Functional Description	Source of Subject Terms for Indexing	Wisest Subsequent User Action(s)
SA	Search for subject and browse an alphabetical list of subjects near your subject (section 5.3.1)	DDC Relative Index entries matching class numbers in the library's bibliographic records	Browse forward or backward in the alphabetical list (BF or BB option), or select a listed Relative Index entry to obtain a subject outline from the classification Schedules (ST option), or select a listed Relative Index entry to display retrieved items (SL option)
SS	Search for subject and browse an outline of subjects related to your subject (section 5.3.4)	Keyword, implicit Boolean AND search of DDC Relative Index entries, DDC Schedules and notes, and the first subject heading listed in the library's bibliographic records directing users to outlines of DDC Schedule captions in the classification area(s) where there are records bearing user-entered terms	Browse more specific DDC Schedule captions (BS option), or select a listed DDC Schedule caption to display retrieved items (SL option)
SD	Search directly for subject and retrieved number of items on your subject (section 5.3.2)	Keyword, implicit Boolean AND search of title, subject heading, series, note, DDC Schedule and note words in bibliographic records	Display retrieved items (DI option)
SC	Search for call number and browse an outline of meanings of call numbers (section 5.3.3)	Class numbers created from the class number field of DDC Schedule records directing users to outlines of DDC Schedule captions in the classification area matching user-entered call number	Browse more specific DDC captions (BS option), or select a listed DDC Schedule caption to display retrieved items (SL option)

A discussion of the internal organizational structure of SOC and DOC showed that SOC and DOC were actually one system in which selected index files and bibliographic files were shared (section 5.4). This sharing of data eliminated redundant information in the database and, thus, reduced the required storage area. We needed both SOC and DOC to conduct retrieval experiments with library patrons and staff. In a production environment, two systems would not be needed. Thus, the organizational structure of an online catalog enhanced with the DDC would not altogether resemble the organizational structure of the experimental online catalog developed for this project.

4. Methods Used to Conduct the Online Retrieval Tests (Chapter 6)

Two online retrieval tests were conducted with the four participating libraries' patrons and staff: (1) a partially controlled but authentic Comparison Search Experiment, in which library patrons conducted online searches on a topic of their own choosing--sequentially--on SOC and DOC (section 6.3.1); and (2) a controlled field experiment, the Sample Search Experiment, in which library staff performed equivalent but different subject searches in SOC and DOC for topics assigned to them by the project data collectors (section 6.4.1). Two retrieval experiments were employed to test the experimental online catalog to ensure a high degree of confidence and strength in the results of the experiments that were obtained under different experimental conditions with different user populations.

In both retrieval experiments, the time spent searching, estimated recall, and precision were dependent and quantitative measures collected in each SOC and DOC search and submitted to quantitative data analyses (sections 6.3.2 and 6.4.2). Patrons and staff in the online retrieval tests were asked which system was more satisfactory for the search and their system preference. They also responded to open-ended questions about ease of system use, system differences, and the reasons for their system preference and search satisfaction. Qualitative data analyses were performed on patron and staff responses to such open-ended questions (sections 6.3.3 and 6.4.3).

5. Online Retrieval Test Results (Chapter 7)

5.1 Searchers' Prior Online Catalog Experience

The majority of library staff in the Sample Search Experiment used the library's online catalog on a daily basis (section 7.2.2). LC patrons in the Comparison Search Experiment were weekly or daily users of MUMS or SCORPIO (i.e., LC's online catalogs). Fifty percent of NYSL and UI patrons were very infrequent online catalog users or had never before used the library's online catalog. PLCFC did not offer online catalog searching to patrons. Patrons in this study searched the library's online catalog less frequently than did participants in related studies of online catalog use (section 7.2.1). The majority of patrons in the Comparison Search Experiment were performing a subject search for personal interest. The largest group of patrons performing searches for research purposes was recorded at LC.

5.2 Time Spent Searching SOC and DOC

The time spent performing online searches in DOC usually exceeded the time spent performing online searches in SOC (section 7.3). On the average, patrons' DOC searches took 13.6 minutes and their SOC searches took 11.5 minutes (table 21); staff DOC searches averaged 9.3 minutes and their SOC searches averaged 7.7 minutes (table 26). The greater length of DOC searches, particularly in the Comparison Search Experiment with patrons, was attributed to DOC's unique subject searching capabilities, unique online displays of subject information, and unique options connected with these searching capabilities or displays. Most patrons encountered these unique capabilities for the first time. Both patrons and staff recognized that DOC had more options and subject searching capabilities than SOC, and these options and capabilities made DOC searches longer.

When patrons and staff accessed the experimental online catalog for the first time and searched SOC, the time spent searching SOC exceeded the time spent searching DOC (tables 22 and 27). However, the difference in time spent searching SOC and DOC was not significant. When patrons and staff accessed the experimental online catalog for the first time and searched DOC, the time spent searching DOC exceeded the time spent searching SOC, and the difference in time between SOC and DOC was significant. Generally, the greater length of the search in the system searched first was primarily due to users' learning how to use the system and familiarizing themselves with the system's capabilities and displays.

Some library patrons and staff noted in post-search interviews that their reasons for satisfaction with the search or system preference were connected with the time spent searching. However, statistical analyses of the time spent searching and search satisfaction or system preference did not establish a relationship between the two factors. In fact, the difference in the average length of time spent searching SOC and DOC was between one and two minutes, so it was not surprising that this difference did not make much of an impression on retrieval test participants' search satisfaction or system preference.

5.3 Estimated Recall and Precision

Recall and precision are traditional criteria for evaluating the searching performance of online retrieval systems. Unfortunately, these criteria have serious drawbacks (sections 7.4.1 and 7.5.1). In this study, estimated recall and precision were calculated from the number of *displayed* items judged relevant by searchers (instead of the number of *retrieved* items judged relevant by searchers). These measures were also calculated from relevance assessments on references (with subject information) to library material, not the full text of a book. Had searchers based their relevance assessments on the full text of a book, their assessments could have been much different. These two drawbacks to estimated recall and precision and other criticisms (Lancaster 1977) downplayed the importance of recall and precision as reliable performance measures in this study. In our analysis of estimated recall and precision, we used these measures to identify problems and inadequacies of SOC and DOC capabilities. Therefore, estimated recall and precision scores were not used to compare SOC and DOC and determine the better of these two systems.

5.4 Estimated Recall in Patron and Staff Searches

The results of statistical analyses for estimated recall in patron and staff searches showed that estimated recall was different with respect to SOC and DOC (section 7.4, tables 28 and 35). In online searches at three of the four participating libraries, estimated recall was significantly greater in SOC than in DOC searches (tables 29 and 36). At UI, however, the estimated recall of SOC and DOC searches was almost the same. The amount of overlap in relevant items retrieved was lower in patron searches than in staff searches. Overall, two of every three relevant items retrieved and displayed by patrons in a DOC search for a given topic were unique and were not retrieved and displayed in a SOC search for the same topic (table 30). Two of every five relevant items retrieved and displayed by staff in a DOC search for a topic was unique and was not retrieved and displayed in a SOC search for the same topic (table 37).

An analysis of patron- and staff-entered terms was performed to explain why the ratio of matched relevant items in patrons' searches was smaller than the ratio of matched relevant items in staff searches even though the same patron performed searches in SOC and DOC for the same topic and two different staff members performed searches in SOC and DOC for the same topic. User-entered terms were categorized into one of three categories and one of 14 subcategories describing the relationship of the user-entered term to the patron's expressed topic or staff's assigned topic (section 7.4.3). The results of the analysis showed that the library staff were more likely than patrons to stick to the terminology of the assigned topic by entering a term that was an exact or partial representation of the expressed topic. Library patrons often entered terms categorized as different from their expressed topics. This analysis also showed that user-entered terms were broader than or exact matches of the expressed or assigned topic. Only 13% of patron-entered terms and 4% of staff-entered terms were more specific than the expressed or assigned topic (table 38).

5.5 Precision in Patron and Staff Searches

The results of statistical analyses for precision in patron and staff searches showed that precision was different in SOC and DOC subject searches (section 7.5, tables 41 and 44). In online searches at three of the four libraries in the Comparison Search Experiment and at two of four libraries in the Sample Search Experiment, precision was significantly greater in SOC than in DOC searches (tables 42 and 45). One of every five items displayed in a patron's DOC search was also displayed in his SOC search for the same topic (table 42). One of every three items displayed in a DOC search conducted by staff was also displayed in a SOC search for the same topic by a different staff member (table 45). Thus, the majority of items and relevant items retrieved and displayed in DOC searches and used to determine precision were unique items and unique relevant items that were not retrieved and displayed in SOC.

6. Failure Analysis of Subject Searching Options (Chapter 8)

The success and failure of the experimental online catalog's subject searching features to direct users to relevant items are featured in chapter 8. The three subject searching capabilities of SOC and four of DOC were not comparable in terms of their performance for retrieving items relevant to a user's expressed or assigned topic (table 48 and 49). Failure analyses of successful and unsuccessful searches and user-entered terms in these searches identified reasons for the different SOC and DOC subject searching capabilities' failure to retrieve relevant items and suggestions for improving these capabilities.

In online retrieval tests, a total of 342 searches were conducted by patrons and staff in SOC, and 338 searches were conducted by patrons and staff in DOC. Successful searches in SOC, i.e., searches resulting in the retrieval and display of relevant items for an expressed or assigned topic, amounted to 90% (section 8.2). Five percent of SOC searches failed to retrieve relevant items in SOC, but a DOC search for the same topic was successful. Five percent of SOC searches failed to retrieve relevant items, and a DOC search for the same topic also failed. Successful searches in DOC amounted to 86%. Nine percent of DOC searches failed to retrieve relevant items in DOC, but a SOC search for the same topic was successful. Five percent of DOC searches failed to retrieve relevant items, and a SOC search for the same topic also failed to retrieve relevant items (table 53). Individual reasons for the failure of SOC and DOC searches are listed in tables 50-52.

6.1 Direct Searches

The percentage of times that the direct search led users to relevant items was greater in DOC than in SOC, and the percentage of times that user-entered terms in direct searches resulted in no retrievals was greater in SOC than in DOC (table 54). Estimated recall scores of DOC direct searches exceeded the estimated recall scores of SOC direct searches conducted by patrons at LC and PLCFC and by staff at LC, PLCFC, and UI (table 55). These results about relevant items, no retrievals, and recall of direct searches were evidence that the enhancement of bibliographic records with the DDC improved subject access in DOC's direct search.

The direct search was particularly effective in retrieving relevant items on a topic when the user-entered term matched words in a relevant subject heading (section 8.3.4). When the user-entered term was not composed of words from relevant subject headings, it sometimes matched words in other fields of bibliographic records or a combination of different fields in these records and retrieved relevant items, nonrelevant items, or resulted in no retrievals. Unlike other online catalog subject searches, the direct search provided no feedback to searchers about the catalog's searching vocabulary (section 8.3.5).

The enhancement of bibliographic records with the DDC sometimes resulted in the retrieval of too many items and false drops in direct searches (section 8.3.6). Most users were able to circumvent such results by entering their term into SOC or DOC using a different subject search option. Another reason for the failure of the direct search was its tendency to misguide users by directing them to a classification area where a number of items on a topic were located based on the retrieval and display of a few items in a set, although there was a better classification number and area where the majority of items on this topic were located.

Patrons and staff liked the ability of the direct search to refer them immediately to retrieved items without having to use other system options and capabilities. However, not all searchers' remarks about direct searches were favorable. Their unfavorable remarks addressed the inability of the direct search to provide feedback about the catalog's searching vocabulary and the absence of a system capability to alter the results of a direct search (section 8.3.7).

6.2 Subject Outline Searches

The results of DOC's subject outline searches were not particularly fruitful in relevant items for a user's topic (tables 57 and 58). Searchers had to employ supporting options to browse and select from online displays of subject terminology. Successful subject outline searches directed users to the specific classification area(s) where there were items matching the user-entered term and relevant to the user's topic of interest (section 8.4.3). In these successful searches, the user-entered term matched a Schedule caption, Relative Index entry, or first-listed subject heading in a bibliographic record. DOC then directed the user to the specific Schedule area, or the user employed the supporting options of the subject outline search to find the specific Schedule area.

In unsuccessful subject outline searches, the user-entered term matched a Schedule caption, Relative Index entry, and/or first-listed subject heading, but the search failed for specific reasons (described in sections 8.4.4-8.4.7) connected with (1) wording of listed perspectives and topics, (2) DOC's grouping procedure in the subject outline search that directed searchers to the shortest class number of retrieved items, (3) the library's assignment of a short class number to items on a specific topic that could have been assigned a longer (i.e., more specific) number, (4) inability of the List of Topics and items retrieved from the selection of a listed topic to express more than one facet of the user's multifaceted topic of interest, (5) the failure of the List of Topics to represent the specificity of the user's topic of interest, and (6) highly posted class numbers assigned to a few items on the user's topic of interest and many items on other topics.

Suggested improvements to the subject outline search to provide better searching performance in such searches are the following:

- Change the grouping procedure so that DOC directs users to the class number and caption with the highest number of postings during the grouping procedure.
- Provide a limit by keyword, date, language, or other criteria as an option when the results of a subject outline search are displayed.

- Enhance the display of retrieved items so that the first items displayed in subject outline searches are those that would be retrieved in a direct search for the user-entered term and bear the class number of the outline.

Suggested improvements to the DDC to provide better searching performance in online catalog searches are the following:

- Enrich the wording of DDC Schedule captions, especially captions accompanying three-digit DDC numbers, so that their wording describes the subject matter of items assigned the particular class number. Provide more subject-rich notes for Schedule captions.

- Increase the specificity of the DDC by adding more specific captions and levels of the hierarchy under highly posted DDC numbers and captions.

The failure analysis of the subject outline search was especially critical of this search option. In the experimental online catalog, the subject outline search provided a new approach to subject searching, and its performance required careful scrutiny to ensure that future system designers do not repeat our design and implementation, but follow our recommendations for improving this capability so that it yields better results in online catalog searches.

In future designs of this subject searching capability, we should not overlook the benefits that searchers derived from this capability:

1. Stimulating users with regard to searching terminology

2. Placing a topic in context

3. Showing where items are located on the shelf

4. Providing a logical organization of topics

5. Providing a capability to browse specific topics

6. Showing users the disciplines which treat their topics of interest

7. Referring searchers to a shelf location(s) based on user-entered terms

6.3 Alphabetical Searches

The results of alphabetical searches in SOC and DOC were not particularly fruitful in relevant items for a user's topic (tables 62 and 63). In alphabetical searches, only 28% to 29% of patron- and staff-entered terms were letter-for-letter matches of subject headings, and 1% to 2% of patron- and staff-entered terms were letter-for-letter matches of Relative Index entries. Users' difficulty matching subject headings and Relative Index entries were attributed to their failure to include correct punctuation, abbreviations, and hyphenation in their entered terms and to consult the printed LCSH before or during the online search. Users relied on the supporting options of SOC and DOC for browsing and selecting alphabetically arranged subject headings and

Relative Index entries. Because of these lists and supporting options, 53% of patron-entered terms in SOC, 57% of staff-entered terms in SOC, and 40% of both patron- and staff-entered terms in DOC were close matches of a listed heading or entry.

Overall, SOC's alphabetical search directed users to relevant items in a greater percentage of searches than DOC's alphabetical search. Patrons and staff noted the specificity of lists of subject headings in SOC in which main headings and subdivisions often exceeded the initial screen (section 8.5.3). Lists of subject headings helped them to find headings when they misspelled their entered term, to focus on a specific aspect of a broad topic, or to survey the scope and contents of the database. Subdivisions of main headings were particularly helpful for narrowing users' original expressed topics. Some searchers thought that the lists of subject headings in alphabetical searches were lists of related terms to the user-entered term (section 8.5.4). These searchers and others (who recognized that the lists of subject headings were an alphabetical arrangement) expressed a need for related terms and cross-references in the catalog.

There were successful alphabetical searches in DOC when there was a Relative Index entry describing the user-entered term or one facet of the user-entered term (section 8.5.5). The main benefit of DOC's alphabetical search was its ability to direct the user to one shelf area where there were items on the user's topic of interest. This was especially helpful when items assigned a subject heading describing the same topic were classed in a number of different areas and the user found a suitable Relative Index entry that directed him to one class number area of interest. DOC's alphabetical search also had the capability to direct users from the alphabetical lists of Relative Index entries to the logical lists of DDC Schedule captions, where users were able to browse listed topics or topics more specific than those listed and found relevant items. However, searchers criticized Relative Index entries for their lack of specificity in comparison to subject headings.

6.4 Class (Call) Number Searching

Call number searching in both SOC and DOC required users to first identify a class number of interest using a subject searching option other than the call number search option (section 8.6). Both patrons and staff culled the class number in retrieved, relevant items displayed in alphabetical, direct, or subject outline searches, entered these numbers into the system, and, in many instances, retrieved additional relevant items. Sometimes they culled a class number from the results of an alphabetical or direct search that was highly posted in a call number search and, thus, did not retrieve additional relevant items because there were items on many different and general topics assigned the same class number as the one culled by the searcher. Searchers preferred DOC's call number search to SOC's call number search, because the former provided them with a List of Topics from which they could choose a listed topic or manipulate the list by browsing more specific or general topics.

A searcher usually needed some guidance entering class numbers--from the results of searches other than call number searches or from the Subject Guide (1978) listing of subject headings and class numbers. Otherwise, entering a class number was like a shot in the dark because the searcher did not know the meaning of a class number in SOC or DOC until retrieved items or the List of Topics was displayed, respectively. In shot-in-the-dark searches in SOC, searchers repeatedly entered different class numbers and displayed a few items until they obtained satisfactory results or gave up. In shot-in-the-dark searches in DOC, searchers employed the browsing and selecting options until they obtained satisfactory results or gave up.

6.5 General Findings about Online Catalog Searching

Searchers of the experimental online catalog noticed the availability of more than one subject searching option. Although the catalogs provided a one- to two-line summary of each subject searching capability, patrons and staff noted that they had to use each capability to distinguish among them. Searchers also wanted the system to automatically identify the subject searching option that would give them the best results for their user-entered term (section 8.7.1). Like searchers in previous studies of online catalogs, searchers in this study had difficulty finding the right terms to enter into the catalog and wanted online aids to help them find searching terminology (section 8.7.2). Patrons and staff wanted to limit the results of their subject searches by various criteria, e.g., date of publication, another term, and chronological period (section 8.7.3).

For the purpose of the online retrieval tests, SOC and DOC only featured displays of full bibliographic records. Searchers called for brief title displays and display capabilities, such as backing up and skipping forward in the display of records, sorting output, and suppressing items previously displayed (section 8.7.4). Only one of 220 different searchers disliked the display of subject-rich fields first in bibliographic records.

Patrons and staff did not display all items retrieved in online searches. Searchers were less likely to display retrieved items when the number of a set of items exceeded 200 (table 67). The number of times that DOC searches retrieved over 200 items was at least double the number of times that SOC searches retrieved over 200 items. Thus, users' failure to display items probably had an adverse effect on DOC searches because of highly posted sets in DOC searches. DOC users would have benefited from brief title displays to quickly scan titles and identify ones relevant to their topics of interest for which they could have obtained full record displays.

7. Search Satisfaction and System Preference (Chapter 8)

Overall, patrons expressed satisfaction with the SOC search, and staff were divided between SOC and DOC with regard to their search satisfaction (table 71, section 8.8). A significant relationship was established between the search satisfaction of patrons and staff and estimated recall in online searches (tables 31, 32, and 39). Other frequent reasons for searchers' satisfaction with the SOC search were the following: (1) SOC was direct and easy to use and understand to find relevant items; (2) SOC provided specificity and a browsing capability in its alphabetical list of subject headings; (3) the searcher was more familiar with an online catalog based on Library of Congress subject headings; (4) items retrieved in SOC were specific to the user's topic; (5) it probably depends upon the topic searched, but SOC worked well for the search today; and (6) SOC retrieved relevant items faster than DOC.

Patrons performing searches for research purposes expressed satisfaction with the DOC search and preferred DOC (tables 69 and 70). Other frequent reasons for searchers' satisfaction with the DOC search were the following: (1) the subject outline search provided users with topics and options for directing them to relevant items, (2) DOC provided a more thorough search than SOC, (3) DOC provided lists of related topics, and (4) DOC had more options than SOC.

Overall, patrons preferred SOC and staff preferred DOC (table 72). Library patrons' system preference was related to the system yielding greater estimated recall (table 33). In contrast, staff system preference was related to the system yielding greater precision (table 46). The most frequent reasons for searchers' preference for SOC were the same as those cited for their search satisfaction. The most frequent reasons for searchers' preference for DOC were the same as those cited for their search satisfaction with the addition that DOC showed how a topic was treated from various perspectives.

8. Statistics for DOC Databases (Chapter 9)

8.1 DDC Enhancement to DOC Databases

In DOC, every unique class number in the selected areas of the 19th edition of DDC was listed in a Topics record along with its associated Schedule caption and notes and Relative Index entries. Summary statistics for Schedule captions and notes and Relative Index entries per Topics record are given in table 73. These statistics included first-listed subject headings which were pointers to the class number in the Topics record in subject outline searches. The average number of Relative Index entries per class number ranged from 0.89 at PLCFC to 2.21 at UI. The average number of first-listed subject headings per class number ranged from 4.7 at PLCFC to 16.5 at NYSL. There were few Schedule notes per class number; the average 0.14 general notes per class number in LC records was the largest average number among the eight different types of notes across four libraries. Statistics are also provided for the number of words and number of unique words in Schedule captions and notes, Relative Index entries, and first-listed subject headings per class number (see table 74).

The percentages of DDC class numbers in the 19th edition of the DDC Schedules without Relative Index entries in this edition of the DDC Relative Index were the following:

1. LC (330-339, 380-382, 658): 46.2%
2. NYSL (917.47-917.4799, 973.1-973.2, 974.7-974.799): 11.5%
3. PLCFC (790-799): 51.3%
4. UI (510-519): 19.5%

The percentages of Relative Index entries whose class numbers did not match a class number in the Schedules and a posted class number in the online Schedules in DDC were the following:

1. LC: 11.1%
2. NYSL: 0%
3. PLCFC: 29.9%
4. UI: 16.6%

These two sets of percentages demonstrated that there was not a one-to-one correspondence between the Relative Index and Schedules. Thus, the alphabetical search of Relative Index entries could not be the only means of directing searchers to class numbers and captions in the online DDC Schedules.

The average number of fields in bibliographic records and percentages of bibliographic records without the field are listed in table 76. This table includes averages and percentages for subject heading, Schedule caption, Schedule notes, and Relative Index entry fields per bibliographic record.

The contents of subject-rich fields in bibliographic records were analyzed to determine the average number of unique words contributed successively by subject-rich fields (tables 77-79). Overall, subject heading fields contributed an average of 4.15 unique words, and the title contributed an average of 4.91 unique words. The notes, series, and sponsor fields contributed an average of 1.35 unique words. Unique words in Relative Index entries contributed an average of 3.44 words, and unique words in Schedule captions and notes contributed an average of 5.72 words. Even though the Schedule's contribution was last in the analysis, it contributed more unique terms than subject heading or title fields. The sequence of fields in the analysis was reversed (table 78), and the analysis was performed without subject heading fields (table 79).

Statistics of the contributions in unique words of subject-rich fields suggested that the DDC was a major contributor of unique subject-rich words to bibliographic records. To confirm this conclusion, we analyzed a random sample of the four libraries' bibliographic records to determine whether the DDC record enhancement was a satisfactory or an unsatisfactory indicator of an item's subject contents. The results showed that LC and PLCFC Schedules contributed about 25% and 52% unique terms, respectively, to bibliographic records (when the Schedules were last in the sequence of subject-rich fields contributing unique terms to bibliographic records) that were poor indicators of a book's subject contents. These poor indicators came directly from the Schedules. They were also added to records by the DDC Online Project team in our attempt to replace ambiguous Schedule captions with better ones. The NYSL and UI Schedules and Relative Index supplied few unique terms that were poor indicators of a book's subject contents. In view of these results, DDC Schedule captions in certain identifiable areas of the Schedules require rewording to improve their understandability to online catalog users.

9. Interviews with Staff Involved in Classification and Editorial Work at LC (Chapter 9)

The focused-group interviews with Decimal Classification Division staff at LC were a small but significant part of the DDC Online Project (section 9.4). Searching the experimental online catalog gave DCD staff an opportunity to identify and express their unique needs for online catalog capabilities that would help them in their classification and editorial work. With regard to the former, staff preferred the searching and limiting functions of MUMS and SCORPIO to DOC. DOC needs to be enhanced with a limiting capability, Boolean searching, and SOC's list of subject headings to enable staff to do their job effectively.

Staff also wanted to see all the Schedule and Manual notes for each DDC number and wanted the DDC Tables integrated into an online catalog. Then they would not have to consult the printed versions of the DDC and Manual while classifying online. And they recognized that the display capability of the experimental online catalog was inadequate for their needs because they required simultaneous displays of the DDC Schedules, Tables, and retrieved items.

When DCD staff assumed the role of a patron searcher, they realized that terminology in the DDC Schedules and Relative Index was sometimes inadequate, contrived, and difficult to understand. They recommended ways in which this terminology could be improved. The most useful function of the experimental online catalog for classification and editorial tasks was the linkage of the bibliographic records to the Relative Index and DDC class numbers. This linkage would enable staff to identify a candidate class number(s) for a book in hand and to identify and rectify structural problems in the DDC. DCD staff recognized that the experimental online catalog was developed as a library patron's subject searching tool and identified many catalog improvements that would help them effectively accomplish their classification and/or editorial tasks.

10. Online Access to the DDC (Chapter 9)

Three functional areas of library work are served when classification information is available in machine-readable form: (1) editorial work, (2) classification work, and (3) subject retrieval of library materials by patrons and staff. Areas 2 and 3 are addressed in section 9.5 in discussions of a coding scheme for synthesized class numbers and capabilities of an online catalog and online cataloging system enhanced with the DDC.

10.1 A Coding Scheme for Synthesized Class Numbers

In DOC, subject retrieval of items through the DDC was limited to the best match of the class number in the "a" subfield of bibliographic records with a class number enumerated in the DDC Schedules. The individual components of synthesized class numbers (i.e., numbers composed of one or more Schedules and/or Table class numbers) were not handled in this project. A coding scheme is needed to identify the various component parts of synthesized class numbers (section 9.5.1). This coding scheme will enable the integration of the DDC

Tables into a centralized online cataloging system for library staff and an online catalog for library patrons and reference staff.

10.2 Subject Searching in Online Catalogs Enhanced with the DDC

Recommendations are provided in section 9.5.2 for the enhancement of an online catalog's subject searching capabilities with the DDC. The experimental online catalog is redesigned in view of this study's results and without regard to cost or any particular computer's constraints. Our recommendations include the three major sources of subject-rich information about the library's collection: (1) bibliographic records, (2) library classification, and (3) the controlled vocabulary used by the library (which we have assumed is based on the Library of Congress Subject Headings (Subject Cataloging Division 1980).

In our redesign of the experimental online catalog, the four approaches to subject searching, i.e., alphabetical, subject outline, class (call) number, and direct searching, are maintained. However, the end results of each of these approaches, except direct searching, are bibliographic records retrieved by the user-entered or user-selected term in subject searches and/or bookshelf areas where library materials on the user-entered or user-selected term are located.

In a redesigned experimental online catalog, a user-entered class number refers searchers to a List of Topics from the DDC Schedules or Tables or shelflist browsing display of brief title information based on the user's match of a Schedules or Table class number or a synthesized class number (section 9.5.2.1). The intermediate result of an alphabetical search is an alphabetical list of subject headings and Relative Index entries, which the searcher can select to display bibliographic records, related terms (i.e., LC-supplied "see also" and/or "see also from" references or a List of Topics [Schedule captions]), or highly posted class areas (section 9.5.2.2). Direct searching provides a feedback capability that informs the searcher of subject headings common to the items retrieved in low-posted direct searches to reenter through the alphabetical search (section 9.5.2.3). Subject outline searches are improved with a grouping procedure that directs users to the highest posted class numbers and with the display of bibliographic records that are direct matches of the user-entered term before the display of bibliographic records bearing the same class number (section 9.5.2.4). Modification of search results is possible through the standard Boolean operations (AND, OR, NOT) (section 9.5.2.1 and figs. 53, 54, 67, and 71).

10.3 Functions of a Centralized Online Cataloging System

The classification tasks performed by library technical services staff can be facilitated by searching, browsing, and assignment capabilities of up-to-date machine-readable classification authority records in a centralized online cataloging system. Functions of a centralized online cataloging system for handling classification authority records were described in section 9.5.3. The integration of the library classification and controlled vocabulary in a centralized online cataloging system will make the tools of the subject cataloger available in one online source. Not only will library staff be able to search and display authority records for the classification and controlled vocabulary, but they will also have the classification practice of libraries expressed in millions of bibliographic records at their fingertips, so to speak. And they can obtain classification and subject heading data from the online cataloging system's authority records to enhance local bibliographic records and add to the indexes and displays of the library's online catalog. A library's local online catalog can be enhanced with subject searching capabilities using the classification and controlled vocabulary for access by both library staff and patrons. In the local online catalog, library staff can check their own library's classification practice by searching the catalog's database through subject searching capabilities such as the ones described for a redesigned experimental online catalog. A standard machine-readable format is necessary for classification authority records for centralized online cataloging systems and local online catalogs.

11. First Steps toward Integrating the DDC into an Online Catalog (Chapter 9)

We envision that future online catalogs will be able to manipulate the three sources of subject information for a library's collection: (1) bibliographic records, (2) controlled vocabulary, and (3) library classification. Since these three sources of subject information will be gradually introduced to online catalogs, we have made a list of recommendations for introducing a library classification into the subject searching features of online catalogs (section 9.6):

1. Encode the classification number fields of bibliographic records with a subfield coding scheme that identifies the source of the individual segments of class numbers from the Schedules and Tables of the library classification.

2. Build the library classification into a tool for subject access, browsing, and display in an online catalog for use by library patrons and reference staff. The suggested features of this online catalog need not include the direct search nor bibliographic records enhanced with the DDC, which were so costly in terms of storage space. Instead, pointers to the DDC would be maintained in the searchable indexes of alphabetical and subject outline searches.

3. Enhance the library classification with captions and index entries that are understandable to library patrons and express the specific subject matter of items bearing associated class numbers.

4. Improve centralized online cataloging systems with a classification authority function that enables library staff to search the files of classification authority records and bibliographic records and to automatically assign classification authority information to bibliographic records and the local online catalog.

12. Conclusion (Chapter 9)

In online catalogs, the DDC can be a searcher's tool for subject access, browsing, and display. The addition of unique subject-rich terms from the DDC enhances subject access to the online catalog. The DDC provides new strategies for subject searching and browsing that are not possible through the alphabetical approaches of subject headings and/or keywords presently supported by online catalogs. The DDC also enhances the display of subject-rich information in bibliographic records and in displays of the bookshelf areas where retrieved items in online searches are located.

The research conducted in the DDC Online Project increased our understanding of subject searchers' use of library classification in an online information retrieval environment. It provided insight into searchers' problems with online displays of the DDC hierarchy, online bibliographic record displays, and manipulation of online displays, all of which will help system designers in future implementations of the DDC online. The research also produced data and analyses on the use of online catalogs by library patrons and staff. The experimental online catalog was the first implementation of a library classification as a tool for subject access, browsing, and display in an information retrieval system accessed by end users of libraries. The catalog was also tested by these end users in retrieval experiments; their comments about the catalog's strengths and weaknesses were offered as recommendations for improvement and enhancement of the experimental online catalog to ensure that future implementations of the DDC in online catalogs meet with the acceptance and satisfaction of library patrons.

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1986 February 28

1. Project Objectives and Research Questions

In the Dewey Decimal Classification research project, the DDC was studied as an online searcher's tool for subject access, browsing, and display in an online catalog. In American libraries, classification has been relegated to catalogers behind the closed doors of technical processing departments. Classification has been chiefly visible to library users as a device for shelf arrangement of library materials (Holley 1985). In contrast, "European librarians have long favoured the systematic arrangement of their subject catalogues, and to this day the great majority of European libraries possess a classed [card] catalogue" (Sweeney 1985). In an online catalog environment, the Dewey Decimal Classification can be the library user's tool for subject access, browsing, and display. The incorporation of the DDC into the information retrieval environment of an online catalog will open up a new horizon for the future of the Dewey Decimal Classification specifically, and classifications in general, by introducing the classed approach to subject searching of library collections and by providing possibilities for search strategies not feasible through the alphabetical approach of subject headings and/or keywords presently supported by online catalogs.

Mechanization of classification schedules for information retrieval purposes was first carried out by Freeman and Atherton (1968a), who demonstrated that Universal Decimal Classification (UDC) could be used as an entry vocabulary to perform online subject searches in a bibliographic retrieval system. At the time of their study, there were few operational online retrieval systems and even fewer (if any) operational online retrieval systems available to end users, such as library patrons or library reference staff. Subsequent studies of classification and mechanization were limited to the production of printed, offline subject indexes to library collections (Dufton and Talbot 1980; Rigby 1974; Rigby 1981). Thus, the 1968 study of the UDC for online information retrieval was and remains unique.

In fall 1981, thirteen years after the study of the UDC for online information retrieval, a number of factors converged in the OCLC Office of Research to rekindle interest in classification and mechanization and provide impetus for OCLC's Office of Research to describe and propose to Forest Press, publishers of the Dewey Decimal Classification, how the classification could be used to assist library catalog users performing subject searches in an online information retrieval environment. These factors converged as a result of ongoing research and the influence of visiting researchers in the OCLC Office of Research:

1. The growth in the design and implementation of online catalogs which emerged from the CLR-sponsored Dartmouth Conference on OPACs (Kaske and Ferguson 1980)

2. Overwhelming acceptance of online catalogs by end users, such as library patrons and reference staff (Dowlin 1980; Moore 1981), which indicated that this new form of the library catalog would be here to stay
3. Exciting potential for enhancement of online catalogs' features based on Hildreth's (1982b) analysis of ten existing OPACs, an analysis which began in January 1981 as a CLR-sponsored OCLC research project
4. The potential importance of subject access in online catalogs, which was uncovered by Pritchard (1981) in a study of library patrons' input access points to the Library of Congress' online catalogs, by Kaske and Sanders (1980) in focused-group interviews with subject searchers regarding their needs when searching the traditional library catalog, and by OCLC Office of Research staff when helping to construct the survey instrument that was later used to question online catalog users at twenty-nine libraries in five separate but related CLR-sponsored projects on online catalogs
5. The influence on Office of Research staff of OCLC Visiting Distinguished Scholar Pauline Cochrane, whose research on the need for improved subject access to bibliographic records (Atherton 1978) would grow in importance to libraries with the introduction of OPACs
6. Cochrane's earlier work on the UDC for information retrieval (Freeman and Atherton 1968a) and on the Library of Congress Classification (LCC) for information retrieval (Atherton and Tessier 1970)

The realization that the printed 19th edition of the Dewey Decimal Classification was produced by computerized photocomposition (Dewey 1979, xii) prompted Office of Research staff to make inquiries to Forest Press about the availability, for research purposes, of the print tapes used to produce the 19th edition of the DDC. Forest Press replied with interest to OCLC's inquiry proposing research to explore the potential of classification in online catalogs. The Office of Research responded with a letter proposal describing possible avenues of approach to studying the DDC and online catalogs. Forest Press then informed OCLC that the Press had commissioned Inforonics to study the print tapes prepared by Arthur D. Little to produce the 19th edition of the DDC. Inforonics' work with the print tapes was oriented toward editorial management of the data on the print tapes. When Forest Press understood there was no conflict or overlap in the work effort of Inforonics and the research OCLC proposed, Forest Press encouraged OCLC's proposals of research on the DDC and online catalogs and, eventually, became a participant in and supporter of a research proposal to the Council on Library Resources (CLR).

Inforonics' study of the print tapes indicated that OCLC's research on the DDC and online catalogs would depend upon Inforonics' reformatting of the data on the print tapes (for which little documentation existed) into an automated structure for editorial management, i.e., the print tapes were virtually unusable without significant work by Inforonics. Inforonics' commission from Forest Press was to provide the DDC editorial staff at the Dewey Decimal Classification Division of the Library of Congress with an online editorial support system designed to facilitate editorial management of the 19th edition and publication of subsequent editions of the DDC.

In January 1984, the DDC Online Project was initiated by the OCLC Office of Research with the support of the Council on Library Resources, Forest Press, and OCLC. The OCLC project team used selected portions of the DDC produced by Inforonics. Since the DDC produced by Inforonics was formatted by Inforonics for use in an online system for editorial management, we felt that this DDC might have limitations when incorporated into an online catalog as a library patron's tool for subject access, browsing, and display. Thus, the first of three research questions posed in the DDC Online Project addresses this issue. Online retrieval experiments conducted with library patrons and staff searchers of online catalogs address the second and third research questions:

1. Is the DDC online produced by Inforonics suitable to implement in online public access catalogs as an online user's tool for subject access, browsing, and display?
2. When used as a searcher's tool for subject access, browsing, and display, does the DDC online improve the search performance of subject searchers at the library catalog?
3. Do subject searchers prefer an online public access catalog in which the DDC is available as a searcher's tool to an OPAC without the DDC online?

The research project was composed of twelve activities grouped into four phases (fig. 1). Each phase required one or more activities to accomplish a specific objective. Prior to the formal initiation of the DDC Online Project in January 1984, Forest Press and OCLC jointly undertook exploratory research to obtain an understanding of and hands-on experience with the machine-readable version of the Dewey Decimal Classification produced by Inforonics. This exploratory research enabled the DDC Online Project Team at OCLC to become familiar with the machine-readable version of the DDC, which was used in all subsequent steps and phases of the project.

The objectives of the DDC Online Project's four phases are to

1. Use the consensus of experts in the Dewey Decimal Classification to determine strategies for searching and displaying the DDC in an experimental online catalog
2. Demonstrate the DDC as an online searcher's tool for subject access, browsing, and display in an experimental online catalog
3. Test the effectiveness of the DDC as an online searcher's tool in this experimental online catalog in retrieval tests with the patrons and staff of the participating libraries
4. Evaluate the demonstration and test results of the DDC as an online searcher's tool and disseminate the results of the research project

This report of the DDC Online Project consists of nine chapters. Chapter 1 highlights the factors that led to OCLC's proposal of research of classification as a subject searcher's tool in an online catalog and the research questions and objectives of the project. Chapter 2 reviews previous research and publications that have explored the integration of a library classification into the subject searching capabilities of an online catalog. Chapters 3-5 describe the planning, development, and implementation of an experimental online catalog with the DDC as a subject searcher's tool. The methods and procedures used to conduct the online retrieval tests with patrons and staff of the four participating libraries and quantitative and qualitative analyses of collected data are featured in chapter 6.

The findings of the online retrieval tests are detailed in chapters 7 and 8. Traditional performance measures of information retrieval systems--time spent searching, estimated recall, and precision--are discussed in chapter 7 with regard to the drawbacks of these measures in this study and the results obtained for each measure in the online retrieval tests. A failure analysis of the different subject searching capabilities of the experimental online catalog is presented in chapter 8; this chapter not only identifies the strengths and weaknesses of the different subject searching capabilities and ways of improving these capabilities, but it also describes findings about subject searching that are generalizable to online catalogs regardless of their enhancement with a library classification. Chapter 9 contains an analysis of the contribution of the DDC as a provider of subject-rich information to bibliographic records and uses of and needs for a library classification in online catalogs and online cataloging systems accessed by library staff performing classification or editorial tasks. This report concludes in chapter 9 with recommendations for the enhancement of bibliographic records, online catalogs, and online cataloging systems with a library classification.

The research findings of the DDC Online Project chiefly address subject searchers' use of a library classification in the information retrieval environment of an online catalog. These findings provide insight into searchers' problems with online displays of the DDC Schedules and Relative Index, bibliographic record displays enhanced with subject information from the DDC, and online catalog capabilities necessary to support searching, displaying, and retrieving library catalog and classification information. As a research project studying online catalog use, the DDC Online Project furthers our general knowledge of library patron use of online catalogs, regardless of the extent to which these catalogs have been enhanced by a library classification. These research findings address the interests of the project participants involved in the construction and maintenance of the DDC, viz., Forest Press and the Decimal Classification Division of the Library of Congress, library administrators involved in decision making about enhancements to a library's online catalog, and library staff and technical systems staff involved in the design and implementation of an online catalog, in general, and, specifically, of a library classification in an online catalog.

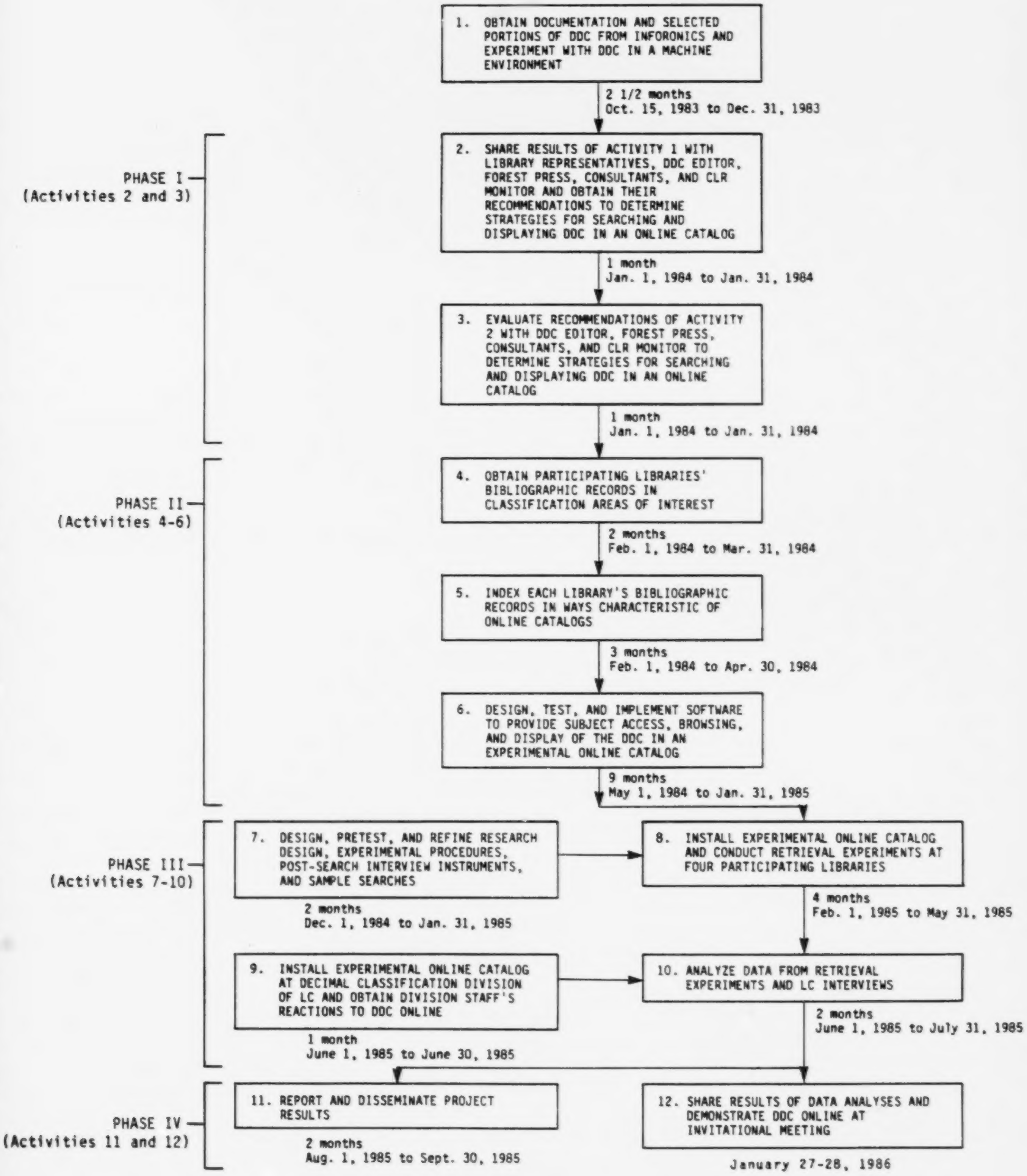
1. OBTAIN DOCUMENTATION AND SELECTED PORTIONS OF DDC FROM INFORONICS AND EXPERIMENT WITH DDC IN A MACHINE ENVIRONMENT
2 1/2 months
Oct. 15, 1983 to Dec. 31, 1983
PHASE I
(Activities 2 and 3)
2. SHARE RESULTS OF ACTIVITY 1 WITH LIBRARY REPRESENTATIVES, DDC EDITOR, FOREST PRESS, CONSULTANTS, AND CLR MONITOR AND OBTAIN THEIR RECOMMENDATIONS TO DETERMINE STRATEGIES FOR SEARCHING AND DISPLAYING DDC IN AN ONLINE CATALOG
1 month
Jan. 1, 1984 to Jan. 31, 1984
3. EVALUATE RECOMMENDATIONS OF ACTIVITY 2 WITH DDC EDITOR, FOREST PRESS, CONSULTANTS, AND CLR MONITOR TO DETERMINE STRATEGIES FOR SEARCHING AND DISPLAYING DDC IN AN ONLINE CATALOG
1 month
Jan. 1, 1984 to Jan. 31, 1984
PHASE II
(Activities 4-6)
4. OBTAIN PARTICIPATING LIBRARIES' BIBLIOGRAPHIC RECORDS IN CLASSIFICATION AREAS OF INTEREST
2 months
Feb. 1, 1984 to Mar. 31, 1984
5. INDEX EACH LIBRARY'S BIBLIOGRAPHIC RECORDS IN WAYS CHARACTERISTIC OF ONLINE CATALOGS
3 months
Feb. 1, 1984 to Apr. 30, 1984
6. DESIGN, TEST, AND IMPLEMENT SOFTWARE TO PROVIDE SUBJECT ACCESS, BROWSING, AND DISPLAY OF THE DDC IN AN EXPERIMENTAL ONLINE CATALOG
9 months
May 1, 1984 to Jan. 31, 1985
PHASE III
(Activities 7-10)
7. DESIGN, PRETEST, AND REFINE RESEARCH DESIGN, EXPERIMENTAL PROCEDURES, POST-SEARCH INTERVIEW INSTRUMENTS, AND SAMPLE SEARCHES
2 months
Dec. 1, 1984 to Jan. 31, 1985
8. INSTALL EXPERIMENTAL ONLINE CATALOG AND CONDUCT RETRIEVAL EXPERIMENTS AT FOUR PARTICIPATING LIBRARIES
4 months
Feb. 1, 1985 to May 31, 1985
9. INSTALL EXPERIMENTAL ONLINE CATALOG AT DECIMAL CLASSIFICATION DIVISION OF LC AND OBTAIN DIVISION STAFF'S REACTIONS TO DDC ONLINE
1 month
June 1, 1985 to June 30, 1985
10. ANALYZE DATA FROM RETRIEVAL EXPERIMENTS AND LC INTERVIEWS
2 months
June 1, 1985 to July 31, 1985
PHASE IV
(Activities 11 and 12)
11. REPORT AND DISSEMINATE PROJECT RESULTS
2 months
Aug. 1, 1985 to Sept. 30, 1985
12. SHARE RESULTS OF DATA ANALYSES AND DEMONSTRATE DDC ONLINE AT INVITATIONAL MEETING
January 27-28, 1986

Fig. 1. Flowchart of project activities

2. Literature Review

The application of data processing equipment and mechanization to library classification schemes dates back to the late 1940s, when punched card equipment was used to express and sort Universal Decimal Classification numbers. Freeman (1964) and Rigby (1974 and 1981) summarized early experiments with computers and classification that predate online bibliographic retrieval systems. These early experiments were preoccupied with the difficulties of expressing and manipulating notations constructed from classification schemes with the available technology (Rigby 1981, 3). By 1964, the information community envisioned the following applications of computers to classification (Rigby 1974, 6):

1. Thesaurus or vocabulary control
2. Control and display of schedules in one or more languages
3. Listing of titles and abstracts
4. Preparation of bibliographies and indexes
5. Selective dissemination systems

The first online bibliographic searching system in which a classification scheme was used for subject access and browsing was demonstrated in 1967-1968 by Freeman and Atherton (1968b). The researchers loaded UDC numbers, English language descriptions or headings of the concept represented by UDC numbers, cross-references, and scope notes of headings in the nuclear science portion of the UDC into an interactive, command-driven system called AUDACIOUS (Freeman and Atherton 1968a). Users entered search arguments expressed in an English-language term or phrase or in a UDC number; Boolean operators were available for use. AUDACIOUS users could even display portions of UDC schedules. In such a system with UDC online for subject access and browsing, Freeman and Atherton (1968a) gave examples to show that users could search by entering a term of interest. A list of classification headings would be produced in which the term occurred; users could select listed headings to browse related headings in the area of the selected heading.

Since the UDC study, classification in an online retrieval environment has been discussed in numerous published articles. As early as 1968, Richmond enumerated three approaches to the application of computers to classification in libraries; the most interesting approach, in view of this research project, is the compilation of a thesaurus from classification schedules, indexes, and subject headings (Richmond 1968, 219). Writing six years later, Richmond (1974, 10) emphasized that LC class descriptions and indexes would be valuable if converted to machine-readable form, augmented to MARC records, and indexed and/or compiled

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Note: This literature review is based in part on Pauline A. Cochrane and Karen Markey's "Preparing for the Use of Classification in Online Cataloging Systems and in Online Catalogs," which appeared in *Information Technology and Libraries* 4,2 (1985 June, pp. 92-95).

into a super thesaurus. The results of Atherton's Subject Access Project (1978) also underlined the critical need to enhance subject access to libraries' bibliographic records. In view of Richmond's suggestion and Atherton's results in the Subject Access Project, classification captions are used to augment MARC records in the present study.

As libraries began to plan seriously for online catalogs, interest in the findings of catalog use studies was renewed. When reviewing catalog use studies with a view to online catalogs, Atherton (1978) demonstrated that findings of catalog use studies had gone unheeded, and she warned that libraries should not ignore these findings in the design of new online catalogs. Realizing the growing importance of subject access in online catalogs, she suggested, at the first of two Library and Information Technology Association-sponsored institutes on Closing the Catalog held in late November 1978, that "classification schemes used in libraries can provide subject access in online catalogs, and the words in the classification schedule captions may provide the free or natural text needed for greater access to topics in the contextual areas of the schedule, thereby providing a browsing feature in online catalogs" (Atherton 1980, 109).

Conclusions from the CLR-sponsored Online Catalog Projects (University of California 1982; Markey 1983b,a) underlined the critical need for improved subject access to libraries' online databases. Analyses of surveys and transaction logs demonstrated that the largest proportion of user-entered access points were for subject searches (Markey 1984, 77). However, user-entered access points represented by call or class numbers ranged from 3% to 5% of the total number of user-entered access points in transaction log analyses at Dallas Public Library, Syracuse University, and The Ohio State University (Tolle 1983). Such results demonstrate that a lot of subject searching is going on at the online catalog, but few subject searches are expressed as call or class numbers. Online catalog users surveyed in the projects ranked the ability to view a list of related subjects first among improvements to online catalogs (University of California 1982, 107; Markey 1983a, 141).

Online catalog system designers are planning to improve their subject search capability by allowing online catalog searchers to peruse the Library of Congress Subject Headings (LCSH) (Subject Cataloging Division 1980) online, enabling searchers to check related, coordinate, or more specific terms. A comprehensive review of LCSH critiques concluded that LCSH leads searchers out of the subject, not into it (Cochrane and Kirtland 1981). The implementation of the DDC online in this project provided library users with the ability to view a list of subjects conceptually related to their search topic (which is what library users have been doing all along by browsing the bookshelf, i.e., looking for books in the neighborhood of a book already found and judged relevant by the user).

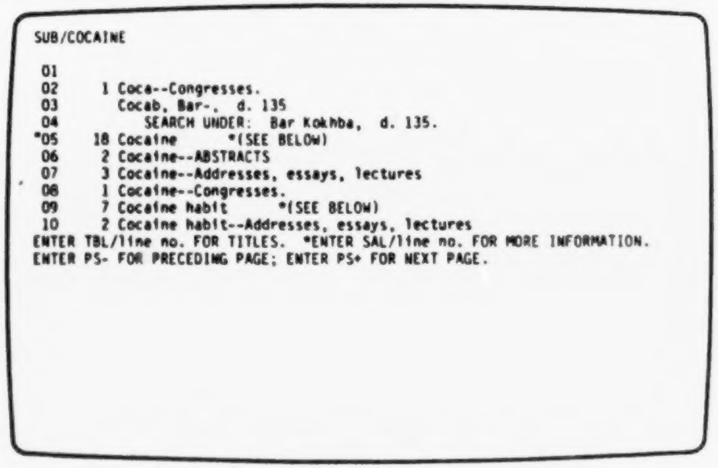
Recently published literature on classification and online catalogs is largely a reiteration of Atherton's idea and early research on the UDC. Svenonius (1981, 94) pointed out that a possible future use of classification in an online environment may be to facilitate bookshelf browsing. Williamson (1982, 133; 1985, 30-31) felt that classification would assume a new and important role in the information environment of the 1980s, especially as a browsing device in online catalogs. Hill (1984, 19-21) warned that libraries' past and present classification practice would often have an adverse effect on the quality of retrieval by classification numbers. Mandel (1981, 16), concerned about the need to improve subject access to libraries' book collections, suggested that Library of Congress classification (LCC) captions from schedules be added to MARC records; her suggestion is similar to the idea in Richmond's 1974 article. Gorman (1981) also noted that the computer would have great value to library classification schemes. Describing a subject retrieval function for the OCLC Online Union Catalog, Mischo (1981) considered an enhancement to the proposed system that would have involved the addition of LC classification schedule terms to subject authority records by matching LC classification numbers (in 053 fields of subject authority records) to the LC classification schedules. Hildreth (1982a) recommended automatic linkages between subject headings and class numbers of retrieved items in online catalog searches to assist searchers in browsing activities at the online catalog.

Two prototype or experimental online catalogs have demonstrated capabilities for browsing the hierarchy in a classification scheme. In the BROWSE system, the Computing Reviews classification was organized into browsing displays (Fox and Palay 1981). The BROWSE system was menu-based and used the tree structure of the Computing Reviews' classification as the framework for the menu-based approach. BROWSE did not allow users to select the part of the classification in which they were most interested. Rather, users had to travel from the most general parts of the classification to the most specific to arrive at the classification area of interest. Geller and Lesk's (1983) experimental menu-based retrieval system at Bell Labs also required users to travel from the most general parts of a classification scheme to the most specific subjects instead of allowing users to go directly to the subjects of interest. Also, the Bell Labs' experimental menu-based system forced Library of Congress subject headings to represent captions in the deep levels of the DDC hierarchy, i.e., when a DDC number exceeded three digits. Bell Labs' experiments indicated that library patrons wanted to select a specific area of the classification for browsing related subjects by entering a term of interest instead of traveling through many successive levels of a hierarchy to arrive at a specific topic. BROWSE and the Bell Labs' system employed library classification schemes to represent the dialogue mode between system and user. In our study, library classification was not studied as a means of representing a menu-based dialogue mode, since previous studies have already demonstrated the limitations of that approach.

Libraries' bibliographic records in online catalogs typically contain classification numbers like the DDC. A number of online catalogs have incorporated class number searching as a mode of subject access. Although the actual search routines for class number searching differ from system to system, most systems search the inverted file of class numbers in the bibliographic database (the cataloging records) and retrieve all the books with the particular call or class number. The major drawback of this approach is that searchers are required to know the exact class number that represents their search topic.

Figure 2 is an example of an online searching feature of LCS, the online catalog of The Ohio State University Libraries, which allows users to browse the shelflist. Users enter an LC class number that they have previously identified as relevant to their interest and retrieve a list of class numbers and titles in shelflist order matching or nearly matching the input call number; users can browse forward and backward in this display.

Online Catalog Search



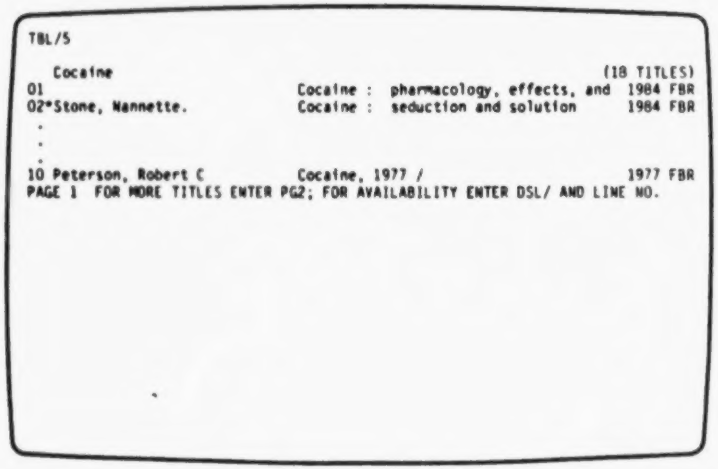
```
SUB/COCAINE

 01
 02      1 Coca--Congresses.
 03        Cocab, Bar-,  d. 135
 04           SEARCH UNDER:  Bar Kokhba,  d. 135.
*05     18 Cocaine      *(SEE BELOW)
 06      2 Cocaine--ABSTRACTS
 07      3 Cocaine--Addresses, essays, lectures
 08      1 Cocaine--Congresses.
 09      7 Cocaine habit      *(SEE BELOW)
 10      2 Cocaine habit--Addresses, essays, lectures
ENTER TBL/line no. FOR TITLES.  *ENTER SAL/line no. FOR MORE INFORMATION.
ENTER PS- FOR PRECEDING PAGE; ENTER PS+ FOR NEXT PAGE.
```

Explanation

The user enters the term "Cocaine" into the online catalog.

The system responds with a list of ten subject headings. If the user-entered term matches an indexed subject heading, this heading is displayed on line 5.



```
TBL/5

   Cocaine                                                         (18 TITLES)
01                          Cocaine :  pharmacology, effects, and  1984 FBR
02*Stone, Nannette.         Cocaine :  seduction and solution      1984 FBR
 .
 .
 .
10 Peterson, Robert C       Cocaine, 1977 /                        1977 FBR
PAGE 1  FOR MORE TITLES ENTER PG2; FOR AVAILABILITY ENTER DSL/ AND LINE NO.
```

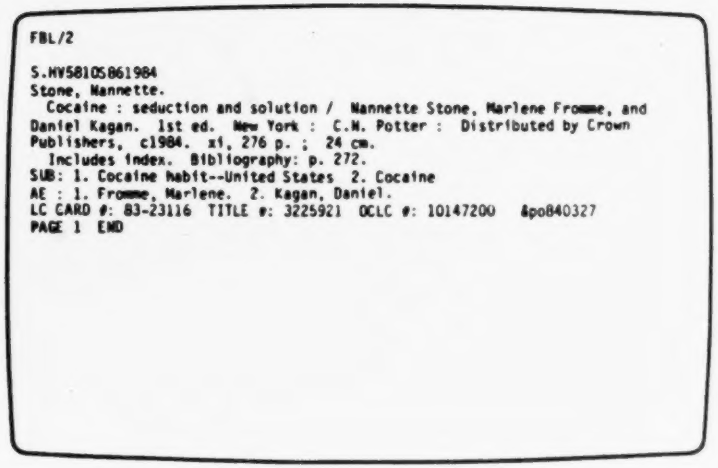
Explanation

The user enters a command to display a list of ten short titles assigned the subject heading "Cocaine."

Fig. 2. Call number (shelf position) search in Ohio State's LCS online catalog (continued on next page)

BEST COPY AVAILABLE

BEST COPY AVAILABLE

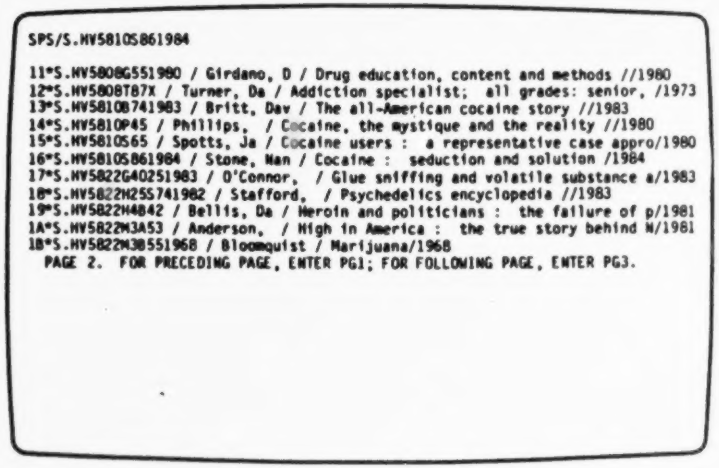


```
FBL/2

S.HV5810S861984
Stone, Nannette.
  Cocaine : seduction and solution /  Nannette Stone, Marlene Fromme, and
Daniel Kagan.  1st ed.  New York :  C.N. Potter :  Distributed by Crown
Publishers,  c1984.  xi, 276 p. ;  24 cm.
  Includes index.  Bibliography: p. 272.
SUB: 1. Cocaine habit--United States  2. Cocaine
AE : 1. Fromme, Marlene.  2. Kagan, Daniel.
LC CARD #: 83-23116  TITLE #: 3225921  OCLC #: 10147200   &po840327
PAGE 1  END
```

Explanation

The user enters a command to display the full bibliographic record of a relevant title listed in the previous short-title list. The user notes this item's call number.



```
SPS/S.HV5810S861984

11*S.HV5808G551980 / Girdano, D / Drug education, content and methods //1980
12*S.HV5808T87X / Turner, Da / Addiction specialist;  all grades: senior, /1973
13*S.HV5810B741983 / Britt, Dav / The all-American cocaine story //1983
14*S.HV5810P45 / Phillips,  / Cocaine, the mystique and the reality //1980
15*S.HV5810S65 / Spotts, Ja / Cocaine users :  a representative case appro/1980
16*S.HV5810S861984 / Stone, Nan / Cocaine :  seduction and solution /1984
17*S.HV5822G40251983 / O'Connor,  / Glue sniffing and volatile substance a/1983
18*S.HV5822H25S741982 / Stafford,  / Psychedelics encyclopedia //1983
19*S.HV5822H4B42 / Bellis, Da / Heroin and politicians :  the failure of p/1981
1A*S.HV5822M3A53 / Anderson,  / High in America :  the true story behind N/1981
1B*S.HV5822M3B551968 / Bloomquist / Marijuana/1968
  PAGE 2.  FOR PRECEDING PAGE, ENTER PG1; FOR FOLLOWING PAGE, ENTER PG3.
```

Explanation

The user enters the call number of the retrieved, relevant record.

The system responds with a list of eleven titles in the "call number" neighborhood of the user-entered call number for the user to browse to find additional items on this subject. The user can browse forward and backward to see more titles in this shelflist area.

Fig. 2. Call number (shelf position) search in Ohio State's LCS online catalog (continued)

The LCS feature is one of many ways system designers have implemented call number or shelflist searching. However, every way that system designers have implemented this feature requires the searcher to know the exact call number of interest (Cochrane and Markey 1985, 98).

This review has pointed out the trends in the application of computers to library classification. Since the late 1940s, there has been steady interest, particularly with regard to the UDC (Rigby 1981). With the advent of online bibliographic retrieval systems, an important research project conducted by Freeman and Atherton (1968a) demonstrated that a classification scheme could be successfully used as an indexing language in an interactive retrieval system. The introduction of online catalogs in libraries in the early 1980s, their acceptance by library patrons, and library users' expressed need for enhanced subject access to MARC records have been the most important factors to stir interest in library classification as a means of improving subject access and browsing techniques. In the past five years, a number of individuals have suggested that DDC and other classifications could be incorporated into an online catalog, and their ideas provide fuel for thought about the use of the DDC for subject access, browsing, and display in an online catalog.

3. Strategies for Searching and Displaying the DDC in an Online Catalog

3.1 Introduction

In the first objective of the DDC Online Project, the consensus of experts in the Dewey Decimal Classification was obtained to determine strategies for searching, browsing, and displaying the DDC in an experimental online catalog. All participants in the DDC Online Project met for a two-day brainstorming session held during the first month of this twenty-month project. The meeting participants were

Julianne Beall, Decimal Classification Division, LC
Jo Calk, Automation Planning and Liaison Office, LC
Lois Chan, University of Kentucky (Project Consultant)
Pauline Cochrane, Syracuse University (Project Consultant)
John Comaromi, Decimal Classification Division, LC
John Finni, Inforonics, Inc.
John Humphry, Forest Press
Karen Markey, OCLC
Margaret Morrison, General Reading Rooms Division, LC
Richard Palmer, Public Library of Columbus and Franklin County (PLCFC)
Peter Paulson, New York State Library (NYSL)
Keith Russell, Council on Library Resources (CLR)
Geraldene Walker, OCLC
Arnold Wajenberg, University of Illinois at Urbana-Champaign (UI)
Robert Zich, Planning Office, LC

Prior to the meeting, all participants were sent a meeting agenda and over forty-five pages of handouts describing our suggestions for searching and displaying the DDC in an online catalog. The meeting centered on the discussion and resolution (through consensus) of issues concerning the integration of the DDC into the subject searching, browsing, and display capabilities of an online catalog. The discussion was led by the project consultants and concentrated on the following four issues:

1. What user actions induce online displays of the DDC Schedules, Tables, and Relative Index?
2. How can the DDC be best indexed to respond to users' actions?
3. How can users manipulate the DDC online?
4. What do online displays of the DDC (Schedules, Tables, and Relative Index) look like?

The participants resolved (through consensus) these four issues. The conclusions reached concerning the issues were categorized into two areas, viz., sources of subject information in the DDC and online searching strategies using the DDC. The conclusions are summarized in the next two sections of chapter 3.

3.2 Sources of Subject Information in the DDC

There are four sources of subject information in a library classification that can aid subject searchers to match their terms with those in the online catalog and to browse for better terms to express their topics: (1) the subject terminology in classification schedules and tables, e.g., headings, scope notes, including notes, (2) subject terminology in the index to the classification schedules, (3) arrays of terminology in the schedules and tables whose relationships to each other are evident (from indentions in the printed schedules or class number notation), and (4) class numbers in the schedules, tables, and index.

Meeting participants asked specific questions about these four sources of subject information. The questions are categorized into four areas: (1) DDC Relative Index, (2) DDC Tables, (3) DDC Schedules, and (4) DDC class numbers. Accompanying each question are meeting participants' responses and the action taken by the DDC Online Project team when developing the experimental online catalog in which the DDC was incorporated as a subject searcher's tool.

1. DDC Relative Index

    a) Should we include DDC Relative Index in the experimental online catalog?

    Response
    Yes: 12 people
    No: 0 people

    Action
    The DDC Relative Index was included in the experimental online catalog.

    b) Should we include the entire DDC Relative Index (DDCRI) in the experimental online catalog for the retrieval tests or only load those parts corresponding to the classification area(s) selected by each library?

    Response
    Entire Relative Index: 4 people
    Parts of the Relative Index: 8 people

    Action
    Only those parts of the DDC Relative Index corresponding to the classification area(s) selected by each library were included in the experimental online catalog.

    c) Should abbreviations in DDCRI be spelled out in online displays?

    Response
    Yes: Majority of group
    No: Minority of group

Action
Abbreviations in the Relative Index were spelled out in online displays.

d) Should DDCRI entries maintain indentions (as in printed DDC Relative Index) or be separated by a symbol such as / or ;?

Response
The group agreed that it would be helpful to view sample screens in a prototype to make a decision.

Action
Secondary Relative Index entries were concatenated to the main and/or secondary index entry and indentions were replaced by two hyphens. (This made entries look like subject headings.)

e) Should secondary Relative Index entries, i.e., entries that are indented under the main index entries, and subdivisions of assigned subject headings be separated into secondary screens linked to the first by prompts?

Response
The group agreed that it would be helpful to view sample screens in a prototype to make a decision.

Action
Secondary Relative Index entries were concatenated to the main and/or secondary index entry and indentions were replaced by two hyphens. Thus, secondary screens were not needed to display entries indented under the main entries.

f) Should postings (i.e., number of books or items) be included in browsing displays of DDC Relative Index entries?

Response
Yes: 8 people
No: 4 people

Note: The group agreed that it would be helpful to view sample screens in a prototype to confirm their response to this question.

Action
Postings were included in browsing displays of DDC Relative Index entries.

g) Should DDC numbers be maintained in online displays of the Relative Index?

Response
Yes: 8 people
No: 4 people

Note: There were some group members who were concerned that patrons would be confused by the inclusion of DDC class numbers, particularly patrons at LC who were more familiar with LC class numbers than DDC numbers.

Action
DDC numbers were not maintained in online displays of the Relative Index for two reasons. In a display of Relative Index entries, users could choose an option to display items posted to a Relative Index entry whose class number was common to the items and the Relative Index entry. The retrieval software that was the basis for the experimental online catalog was limited to displaying eighty characters per line; a significant programming effort would have been necessary to display Relative Index entries as they are printed in the DDC Relative Index.

2. DDC Schedules

a) Should DDC numbers be maintained in online displays of the DDC Schedules?

Response
Yes: 8 people
No: 4 people

Note: There was concern that LC users would not benefit from DDC numbers listed in online displays since the Library of Congress' collection is organized according to the Library of Congress Classification (LCC).

Action
DDC numbers were maintained in online displays of the DDC in installations of the experimental online catalog at all participating libraries, but were labeled "AREA" in the LC installation and "LOCATION" in the three other installations.

b) Should DDC numbers containing the "formerly" reference or DDC numbers in brackets be maintained in online displays of the DDC Schedule? What if there are books classed in both numbers (i.e., the "formerly" reference and valid class number)?

Response
The group recommended that the postings under both numbers be combined so that the same items are retrieved in old and new numbers. There was a consensus that if this procedure was followed, terminology such as "formerly" and brackets would be dropped from online displays.

Action
Records from the Library of Congress and University of Illinois were not affected because they were assigned by classifiers using only the 19th edition of DDC. The DDC areas selected by the New York State Library did not contain these references or numbers in brackets. There were only seven class numbers affected in the DDC

Schedule area selected by the Public Library of Columbus and Franklin County. Thus, we did not feel that the programming effort required to automatically reclassify items classed in seven areas was justified. Thus, DDC numbers in brackets and DDC numbers containing the "formerly" reference and libraries' records assigned to these DDC numbers were not included in the experimental online catalog.

c) Should we keep all subject-rich text of the DDC Schedules in online displays?

Response
All subject-rich fields: 3 people
No subject-rich fields: 0 people
Selected fields: 7 people

Note: Fields selected by the participants for indexing and display are met (main entry text), nin (including note), nex (example note), nch (class here note); the majority of the group wanted the not (general note) field indexed but not displayed.

Action
The experimental online catalog developed for the University of Illinois featured the indexing of the contents of the met, nin, nex, nch, and not fields, and display of the contents of the met, nin, nex, and nch fields. When University of Illinois searchers clamored for more subject information in the displays of DDC Schedule notes, the contents of the not field was added to this display in the catalogs developed for LC, NYSL, and PLCFC.

d) If subject-rich text is kept in DDC Schedule displays, how should we label note fields? How should we label note fields when more than one note appears per heading?

Response
Label notes: 2 people
Do not label notes: 9 people

Action
With assistance from Dewey Decimal Classification Division staff, the DDC Online Project team defined terminology for labeling DDC schedule notes and added the labels to the display.

e) How can we designate to users that there are more screens in lower levels of the DDC hierarchy?

Response
The majority felt that prompts at the bottom of the screen would be sufficient to allow users to select more general, more specific, or related portions of the hierarchy. If the user selected a prompt for a narrower level and there was no level at this point, the system would inform the user that there was nothing to display in this regard.

Action
Prompts listed at the bottom of the screen enabled users to select broader or narrower portions of the hierarchy. If the user selected a prompt for a narrower level and there was no level at that point, the system informed the user that there were no more specific topics to display.

f) Should we display headings from the DDC Schedules that have no postings? What if there are books assigned to a DDC number of the next level of the hierarchy?

Response
The majority of the group wanted headings with zero postings listed. It was agreed that a report of postings should be made at all levels in the hierarchy. A report of cumulative postings was suggested; however, John Comaromi felt that a report of cumulative postings would make it impossible to retrieve items at general numbers. After much discussion, the group wanted two reports of postings: (1) cumulative postings and (2) postings for the number of items assigned a specific class number.

Action
Schedule headings with zero postings were listed. A prototype showed only a display of cumulative postings; retrieved items were displayed in class number order so that items with the exact number shown in the display of schedule headings, class numbers, and postings were the first items displayed. The DDC Online Project team felt that two displays of postings on a single line would be confusing to online searchers.

g) How much should we indent headings and other subject-rich data in displays of the DDC Schedules?

Response
The majority of the group wanted to review sample screens to make a decision.

Action
The displays of DDC Schedule headings were entitled by a heading in one level higher in the DDC hierarchy than the other displayed Schedule headings that were all at the same level of the hierarchy. Thus, indentions were not necessary.

h) Will the text of DDC headings in the Schedules be understandable to users, or do we have to edit selected headings?

Response
Edit headings: 5 people
Do not edit headings: 5 people

Action
We did not alter the text of DDC Schedule headings at NYSL, PLCFC, and UI because we wanted to find out users' reactions to headings. Headings altered in the DDC Schedules for LC are listed in section 4.3.2.4.

i) How can we (automatically) identify not (i.e., general note) fields that do not have subject-rich information?

Response
The majority of the group did not want not fields displayed (see 2c) but they did want the text in not fields indexed (so that users could match their terms with those in not fields).

Action
(See item 2.c above.)

3. DDC Tables

a) Can we automatically add Table references to the system?

Response
New York State Library chose two classification areas for study: New York State (NYS) history (class numbers beginning 974.7) and NYS geography (class numbers beginning 917.47). DDC numbers must be built from Table 2 to represent specific topics about NYS history and geography, e.g., geography of the Niagara Frontier or discovery of Niagara Falls. Unfortunately, the notation coded in MARC records is not adequate to automatically identify augmentations of the base number by entries in Table 2.

Action
Inforonics augmented the DDC Schedules under the base numbers for NYS history and geography with Table 2 entries beginning at 747 (i.e., New York State). Thus, the machine-readable DDC Schedule for NYS history and geography resembles the 16th edition of the printed DDC for these two areas. Relative Index entries beginning with the "area-747" designation were concatenated to a 91 and a 9, and separate Relative Index entries were made from the former, to which the phrase "geography of and travel" was added to the original entry, and from the latter, to which the phrase "History" was added to the original entry. This was an attempt to integrate DDC Schedules and Relative Index entries with Table references in a classification area for which the library has a substantial collection.

4. DDC Class Numbers

a) Should we include class number searching in the experimental online catalog?

Response
The majority of the group wanted class number searching.

Action
The experimental online catalog features class number searching.

b) Representatives from participating libraries volunteered the class number area(s) that they would like studied in the installation and testing of the experimental online catalog in their respective libraries. All four libraries chose science or social science areas of the classification, but advice from consultants helped to change one selection to a humanities area. The areas selected by the four participating libraries were the following:

(1) Economics (330-339), Commerce (380-382), and Management (658) at the Library of Congress.
(2) New York State Geography (917.47), New York State History (974.7), and U.S. Colonial History (973.1-973.2) at New York State Library.
(3) Sports and Performing Arts (790-799) at the Public Library of Columbus and Franklin County.
(4) Mathematics (510-519) at the University of Illinois at Urbana-Champaign.

3.3 Online Searching Strategies Using the DDC

Meeting participants discussed online searching strategies using the DDC by tackling four questions:

1. In subject searches, when will browsing displays of the DDC Schedules and Index be most helpful to users?

2. When users retrieve one classification area in a keyword search, should the resulting display of the DDC Schedule be the same level of the hierarchy, narrower level, or broader level? What if there is no narrower level? (See fig. 3.)

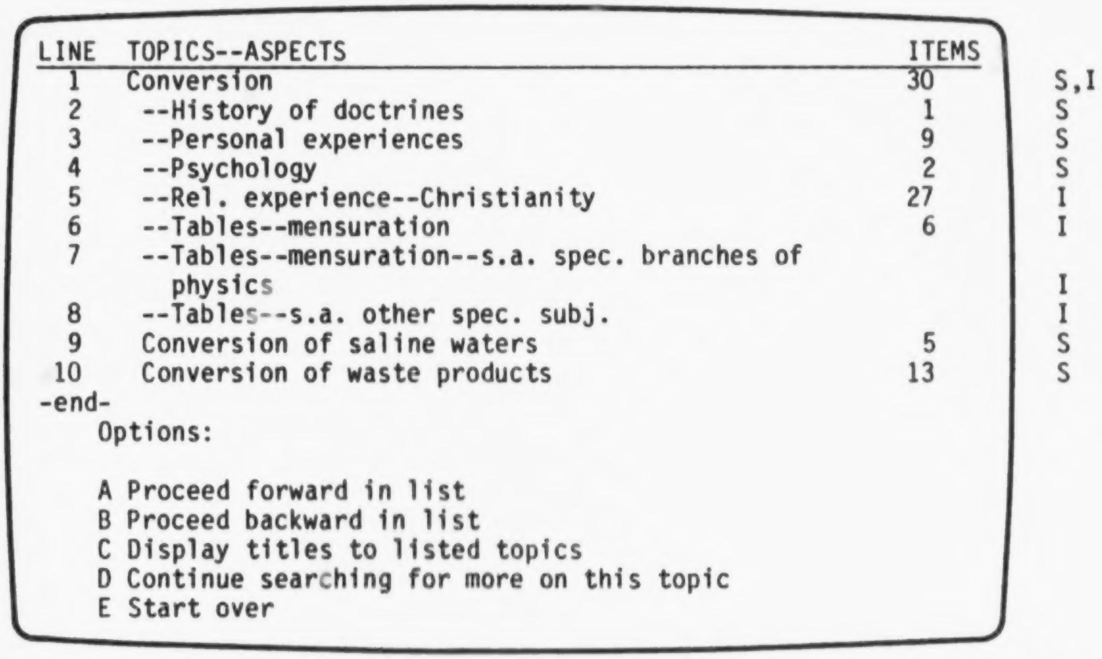
3. When users retrieve more than one classification area in a keyword search, how many levels of the hierarchy should be displayed (in the form of DDC captions)?

4. Are there other strategies for searching the DDC that we have not considered?

Meeting participants expressed their reactions to these questions and to handouts prepared by the DDC Online Project team that showed how we envisioned online catalog displays of the subject information in the DDC. We first envisioned a combination of Relative Index entries and subject headings in an alphabetical list (see fig. 3). Advice from project participants and consultants helped us to refine this display with respect to (1) search and display option names and accompanying explanations, (2) exclusion of subject headings from the alphabetical list, (3) systems messages explaining the contents of this display, (4) concatenation of secondary Relative Index entries to the main Relative Index entry (expressed in the printed DDC Relative Index by indentions) and replacement of indentions by two hyphens, (5) inclusion of two Relative Index entries alphabetized before the user-entered term that matched or almost matched the indexed Relative Index entry, and (6) inclusion of subject searching to trigger a display of DDC Schedule captions for the user-selected entry. This display and others prepared by the project team or meeting participants in response to the discussions improved the design and interface of the experimental online catalog.

USER: Conversion

SYSTEM: There are 10 aspects of this topic:



```
LINE  TOPICS--ASPECTS                                    ITEMS
  1   Conversion                                           30      S,I
  2    --History of doctrines                               1      S
  3    --Personal experiences                               9      S
  4    --Psychology                                         2      S
  5    --Rel. experience--Christianity                     27      I
  6    --Tables--mensuration                                6      I
  7    --Tables--mensuration--s.a. spec. branches of
         physics                                                   I
  8    --Tables--s.a. other spec. subj.                            I
  9    Conversion of saline waters                          5      S
 10    Conversion of waste products                        13      S
-end-
    Options:

    A Proceed forward in list
    B Proceed backward in list
    C Display titles to listed topics
    D Continue searching for more on this topic
    E Start over
```

<u>KEY</u>. Source of terms:
S = assigned subject headings of bibliographic records

I = DDC Relative Index

Note: In this strategy, subject headings from a library's bibliographic records and entries from the DDC Relative Index are combined into a display of alphabetized precoordinated terms. If a user's initial term in his query matches an indexed subject heading or Relative Index entry, this type of display is triggered.

Fig. 3. Example of a subject searching strategy using a combination of subject headings and Relative Index entries

At the conclusion of the two-day meeting, the project consultants expressed the process of searching the DDC in flowchart format (fig. 4). The entire flowchart represents the experimental online catalog in which the DDC has been incorporated as an online searcher's tool (hereafter called the Dewey Online Catalog or DOC). When figure 4 is folded in half vertically, the left half represents the experimental online catalog without the DDC (hereafter called Subject Online Catalog or SOC). (SOC was developed for comparison with DOC in online retrieval tests with library patrons and staff.) The DDC Online Project team expressed this process of searching the experimental online catalog (SOC and DOC) in a prototype. The prototype was programmed in APL on OCLC's mainframe computer. This enabled project participants who had attended the initial meeting of participants in January 1984 to use a dial-up terminal and modem to access the prototype from their respective offices. Their reactions to this prototype resulted in more improvements to the design and interface of the experimental online catalogs. These participants' involvement in the design of the experimental online catalog did not end with their reactions to the prototype. We obtained their reactions to a test load of two-hundred records into the experimental online catalog developed for the University of Illinois, which was the first library where the experimental online catalog was installed and tested in online retrieval tests. Participants' reactions to the Illinois experimental online catalog are discussed in section 5.6.

3.4 Discussion of Experts' Recommendations

In the DDC Online Project proposal to CLR[1], we pledged to include an account in the final report of the recommendations of experts in the DDC to determine strategies for searching and displaying the DDC in an online catalog. We felt that their recommendations would include things hoped for rather than things that could be accomplished. In fact, we were able to implement nearly all their recommendations. From their recommendations, we developed an experimental online catalog with:

1. Selected portions of the DDC Relative Index which had
    a) Main entries and secondary entries concatenated by two hyphens
    b) Postings information
    c) Full words instead of abbreviations

2. Selected portions of the DDC Schedules which had
    a) Class numbers
    b) Postings information even when there were no postings
    c) Selected subject-rich notes for indexing and display, i.e., including example, class here, and general notes
    d) Meaningful labels for note fields in a separate display of Schedule notes
    e) User options to display more specific or more general Schedule captions than those displayed in an ongoing search

---

[1] "The Dewey Decimal Classification as an Online Searcher's Tool for Subject Access, Browsing, and Display in an Online Public Access Catalog," dated September 29, 1983

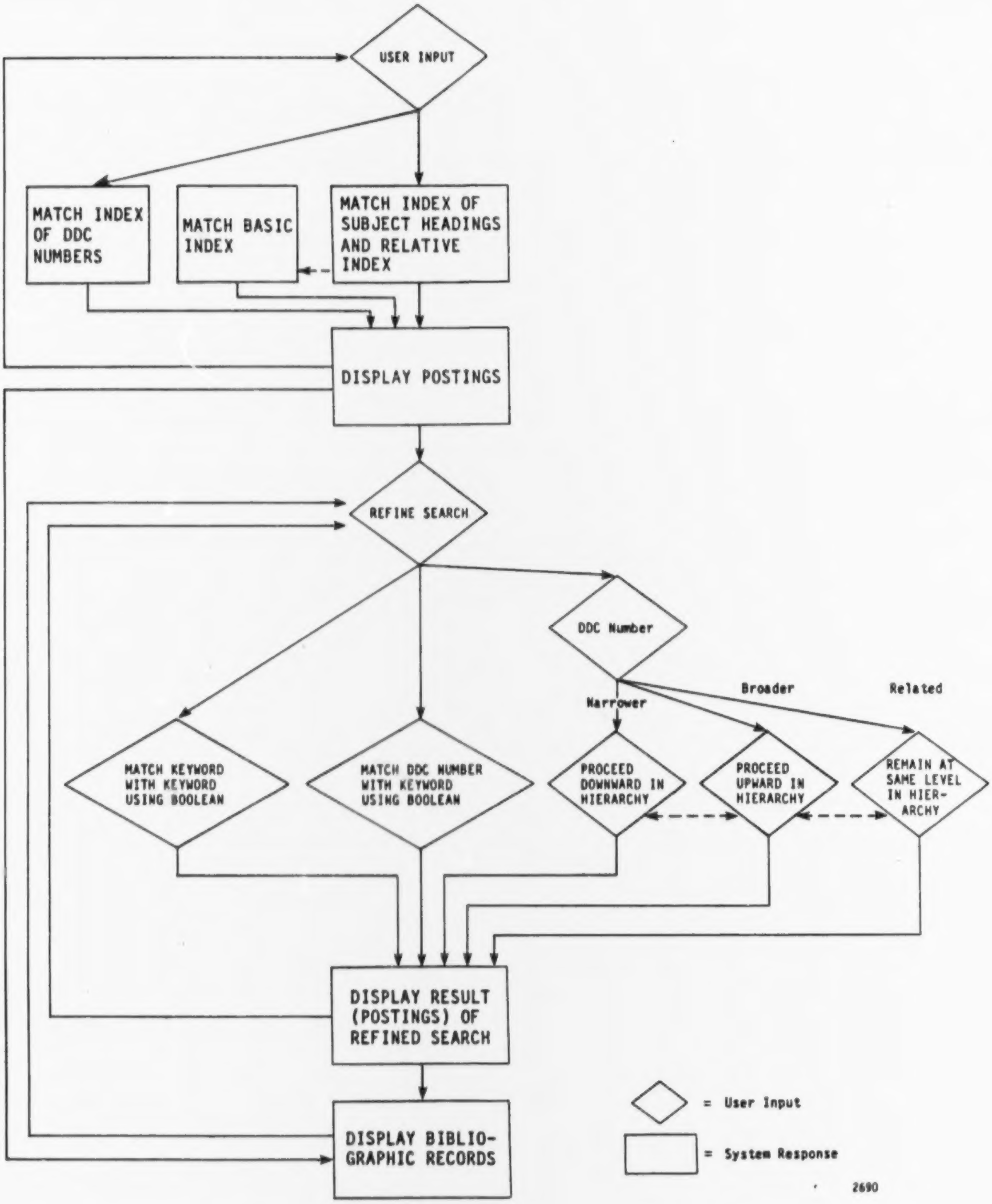

USER INPUT
MATCH INDEX OF DDC NUMBERS
MATCH BASIC INDEX
MATCH INDEX OF SUBJECT HEADINGS AND RELATIVE INDEX
DISPLAY POSTINGS
REFINE SEARCH
DDC Number
Narrower
Broader
Related
MATCH KEYWORD WITH KEYWORD USING BOOLEAN
MATCH DDC NUMBER WITH KEYWORD USING BOOLEAN
PROCEED DOWNWARD IN HIERARCHY
PROCEED UPWARD IN HIERARCHY
REMAIN AT SAME LEVEL IN HIER-ARCHY
DISPLAY RESULT (POSTINGS) OF REFINED SEARCH
DISPLAY BIBLIO-GRAPHIC RECORDS
= User Input
= System Response
2690

Fig. 4. Flowchart of the process of searching the experimental online catalog with the DDC as a subject searcher's tool

3. Table references automatically generated for a portion of the DDC Schedules selected by one of the four participating libraries

4. Class number searching

We were unable to carry out design recommendations for the following: (1) inclusion of DDC numbers in displays of Relative Index entries; (2) automatic reclassification of items classed in a formerly used classification number into the current number(s); (3) automatic identification of general note fields in the DDC Schedules that do not contain subject-rich information; and (4) automatic generation of DDC class numbers enhanced by DDC Table references.

System designers faced with implementing the DDC in online catalogs in the future will have to decide how they are going to carry out the design recommendations that we could not implement (see also section 9.5). Workstations permitting multiple windows will help to alleviate the restrictions involving the number of characters displayed on a single line to accommodate the display of lengthy subject headings and Relative Index entries and accompanying class numbers.

An authority capability for classification records will enable library staff to identify items classed in formerly used classification numbers. In those cases when the note suggests more than one class number for reclassification, library staff will have to review every item bearing the formerly used class number to reclassify. Otherwise, reclassification and shelflisting can be a computer-assisted activity in which items with the formerly used numbers are automatically assigned the new number and the new class number is concatenated to the old Cutter number and the shelflist checked for duplicate numbers; obviously, problems with duplicate numbers have to be manually resolved and new call number labels have to be produced and attached to the actual item.

We recommend that the DDC editors separate general notes from scope notes in the machine-readable DDC Schedules and tag them accordingly in subsequent DDC editions. However, we found few of these general notes in the four libraries' selected class number areas that did not contain subject-rich information.

Automatic generation of DDC class numbers enhanced by DDC Table references is not a trivial task. Inforonics enhanced two of the three class number areas selected by New York State Library by DDC Table references. It was easy for the New York State Library to identify areas of the Schedules where enhanced DDC numbers were needed, viz., New York State history and New York State geography. In the future, libraries that can also identify areas of the DDC Schedules needing Table reference enhancement could specify such areas to Inforonics (or the service organization supplying the machine-readable DDC to licensed libraries or vendors of online catalogs), and a machine-readable DDC would be tailor-made to their specifications.

Another approach to the enhancement of class numbers by Table references is the adoption of special coding to designate the source(s) of Table references in class number fields of MARC records. Wajenberg (1983) has suggested such a coding scheme for the DDC which would designate source(s) of Table references, sources of Schedule references added to the class number, and hierarchical relationships among class numbers. His work would not only allow us to identify the source(s) of Table references, but enable us to add Table information into an online catalog in much the same way that we added the DDC Schedules and Index into an online catalog as a searcher's tool for subject access, browsing, and display in this project (see also section 9.5.1).

The process of searching the experimental online catalogs was shown in a flowchart in fig. 4. In general, this process was represented by the experimental online catalog's subject searching capabilities. However, we were faced with a severe space limitation in the LSI-11 computer equipment used to develop these catalogs. To alleviate the limitation, we decided to eliminate Boolean searching capabilities associated with refining the ongoing subject search. We did not think that this refinement technique would be crucial to the experimental online catalog because both SOC and DOC still featured a keyword searching capability with implicit Boolean operations. But the user had to reenter his topic expressed in a single search statement rather than use the results of previously entered search statements and Boolean operations. Results in online retrieval experiments (see chapter 8) proved that such a search refinement using Boolean operations would have been an important component of the searching process in the experimental online catalog. In retrospect, we feel that the omission of this refinement technique provided us with valuable knowledge of users' needs in an online catalog in which the DDC has been incorporated as a searcher's tool for subject access, browsing, and display.

3.5 Summary

In the first objective of the DDC Online Project, the consensus of experts was obtained to determine strategies for searching, browsing, and displaying the DDC in an online catalog. A meeting was held in Washington, D.C., that included the Dewey Decimal Classification Division, Forest Press, Inforonics, OCLC, project consultants, and representatives of the four libraries participating in the project.

The participants resolved four major issues concerning the implementation of the DDC in an online catalog and made recommendations that were categorized into two areas: (1) sources of subject information in the DDC and (2) online searching strategies using the DDC. In the experimental online catalog developed in the project, we were not able to carry out all the recommendations expressed by the experts. However, we acknowledged the reasons for not being able to carry out experts' recommendations and suggested how such recommendations could best be carried out in the future.

4. Machine-readable Data for the Development of the Experimental Online Catalog

4.1 Introduction

The databases of the experimental online catalog were created from three data sources: (1) MARC records from the four participating libraries in selected subject areas of the Dewey Decimal Classification, (2) the 19th edition of the DDC Schedules, and (3) DDC Relative Index. The subject areas selected by participating libraries were the following:

1. Economics (330-339), Commerce (380-382), and Management (658) at the Library of Congress
2. New York State Geography (917.47), United States Colonial History (973.1-973.2), and New York State History (974.7) at the New York State Library
3. Sports, Recreation, and Performing Arts (790-799) at the Public Library of Columbus and Franklin County
4. Mathematics (510-519) at the University of Illinois at Urbana-Champaign

Each library contributed between 8,000 and 15,000 MARC records, in the chosen subject areas, from its own collection of bibliographic records. The records were in LC/MARC, OCLC/MARC, or similar format and were provided on tape. Most of the records were accepted for processing into the experimental online catalog; some records were not accepted for processing because they contained errors or were duplicates.

Forest Press contributed DDC information in the four selected subject areas. Although the *Dewey Decimal Classification* is composed of three printed volumes (i.e., the *DDC Tables* (Volume 1), *DDC Schedules* (Volume 2), and *DDC Relative Index* (Volume 3)), the DDC information used in this project was taken only from the *DDC Schedules* and *DDC Relative Index*. Inforonics, Inc., with support from Forest Press, is developing an editorial support system for the Decimal Classification Division (DDC editorial staff) of the Library of Congress. This system will help Forest Press and the Division to reformat the machine-readable data in the print tapes of the 19th edition of *DDC* into an automated structure designed to facilitate editorial management of the 19th edition and publication of future editions in whatever medium might be desired. The result of Inforonics' processing of the DDC print tapes provided the raw data for the DDC Online Project team's selections of fields and text in the Schedules and Relative Index for subject searching, browsing, and display in the experimental online catalog.

This chapter describes the selection of subject information and other information from the three data sources used to develop the experimental online catalog: (1) DDC Schedules, (2) DDC Relative Index, and (3) libraries' bibliographic records. "Other" information constituted that part of the data selected for inclusion in the experimental online catalog's database that helped a user to determine the relevance of and find a retrieved item in the participating library's book collection. For example, "other" information was descriptive cataloging information, such as author, publisher, and year of publication. This chapter also covers special manipulation of the machine-readable Schedules, Relative Index, and bibliographic records to process essential and desired data for the experimental online catalog.

The experimental online catalog was composed of two systems: (1) DOC or Dewey Online Catalog, i.e., the catalog whose subject searching capabilities had been enhanced with the DDC Schedules and Relative Index; and (2) SOC or Subject Online Catalog, i.e., the catalog without the DDC Schedules and Relative Index. When the DDC Schedules and/or Relative Index are discussed in this and other chapters, DOC's capabilities are addressed. When libraries' bibliographic records are discussed, the capabilities of both DOC and SOC are addressed.

4.2 Sources of Machine-readable Data for the Experimental Online Catalog

4.2.1 DDC Schedules

The DDC is a systematic arrangement of knowledge by subject. "The Dewey Decimal Classification is a hierarchical system using the decimal principle for the subdivision of knowledge, as represented in publications, that is, each group in the successive division of knowledge from the broadest to the most minute, is divided on a base of 10" (Dewey 1979, xxviii). This hierarchical arrangement made it possible for us to easily build and manipulate browsing displays of the DDC.

In fig. 5, the DDC hierarchy from 796.5 to 796.545 is given. In this project, we viewed each node of the hierarchy as represented by three pieces of information: (1) a DDC class number; (2) a DDC Schedule caption or heading; and (3) zero or more Schedule notes. Generally, the captions bear the meaning of DDC class numbers. DDC Schedule notes provide additional subject information about the DDC class number or instructions to classifiers. In fig. 5, node 796.5 has "796.5" as the DDC class number, "Outdoor life" as its caption or heading, and no notes. Node 796.5422 has "796.5422" as the DDC class number, "Institutional" as its caption, and "Examples: school, church, YMCA, scouts" as a note. (The many types of notes in the DDC Schedules are described in section 4.3.2 and appendix B.)

796 Athletic and outdoor sports and games

•
•
•

.5	Outdoor life
.51	Walking
	Class here backpacking
	For walking in specific kinds of terrain, see 796.52
.52	Walking and exploring in various specific kinds of terrain
.522	Mountains, hills, rocks
.522 3	Rock climbing
.525	Caves
	Spelunking
.53	Beach activities
	For aquatic sports, see 797.1-797.2
.54	Camping
.542	Kinds of camps
	Class here camps operated for profit
	Class activities in specific kinds of camps in 796.545
.542 2	Institutional
	Examples: school, church, YMCA, scouts
	Class institutional day camps in 796.5423
.542 3	Day
.545	Activities
	Examples: woodcraft, campfires, games
	For beach activities, see 796.53

•
•
•

Fig. 5. Printed *DDC Schedules* from 796.5 to 796.545

4.2.2 DDC Relative Index

The DDC Relative Index arranges entries alphabetically word by word. As a *relative index*, this index "reverses the subordination of subject to discipline, thus bringing together from all disciplines the various aspects of individual subjects" (Dewey, 1979, lxxx).

In fig. 6, a small portion of the Relative Index under the word "Camping" is given. In this project, we viewed each DDC Relative Index entry as represented by two pieces of information: (1) an alphabetical main entry with zero or more secondary entries (expressed as indentions in the text) and (2) a DDC class number. For example, the Relative Index entry "Camping" is a main entry with two secondary entries, "equipment" and "armed forces," and the class number 355.81. Another example is the Relative Index entry "Camping" as a main entry with one secondary entry, "sports," and the class number 796.54.

```
Camping
  equipment
    armed forces                        355.81
      s.a. spec. mil. branches
    manufacturing
      soc. & econ. aspects see
           Secondary industries
      technology                        685.53
  sports                                796.54
  other aspects see Sports
```

Fig. 6. Printed DDC Relative Index under "Camping"

4.2.3 Machine-readable Cataloging (MARC) Records

Machine-readable Cataloging (MARC) records are bibliographic records in a standardized and documented format for multiple uses. Figure 7 is an example of a MARC record in the OCLC/MARC format.

```
OCLC: 9791405      Rec stat: n    Entrd: 830809            Used: 840223 ¶
Type: a Bib lvl: m Govt Pub:      Lang: eng  Source: d     Illus: a   ⊦
Repr:   Enc lvl: I Conf pub: 0    Ctry: nyu  Dat tp: s     M/F/B: 10 ⊦
Indx: 0 Mod rec:   Festschr: 0    Cont:     ⊦
Desc: a Int lvl: j Dates: 1981          ¶
▸ 1 010       ¶
▸ 2 040       SOM ‡c SOM¶
▸ 3 020       059032389X (pbk.): ‡1.95¶
▸ 4 092       796.54 ‡b STI¶
▸ 5 049       OCLC ¶
▸ 6 100 10    Stine, Jovial Bob¶
▸ 7 245 14    The cool kids guide to summer camp/ ‡c by Jovial Bob Stine⊦
and Jane Stine; illus. by Jerry Zimmerman.¶
▸ 8 260 0     New York: ‡b Scholastic Book Services, ‡c c1981¶
▸ 9 300       98 p.: ‡b ill.; ‡c 18 cm.¶
▸10 490 0     Vagabond Books¶
▸11 650 1     Camps.¶
▸12 700 10    Stine, Jane, ‡e jt. auth.¶
▸13 700 10    Zimmerman, Jerry, ‡e illus.¶
```

Fig. 7. OCLC/MARC record

A MARC record is composed of a fixed part and a variable part. The fixed part contains information, such as the type of material, the language the material is written in, and the location where the material was published. For example, "Bib lvl: m" means that the item is a monograph and "Lang: eng" means the language is English (fig. 7, second line). The variable part of the MARC record contains numbered lines and is composed of fields called tags. Each tag is labeled with a three-digit number and terminated with ¶. A tag is composed of subfields, each labeled with a letter or digit preceded with ‡. For example, tag 245 is for the title (fig. 7, line number 7), tag 100 is for the author (fig. 7, line number 6), tag 700 is for a joint author (fig. 7, line number 12), and tag 260 is for the publisher (fig. 7, line number 8). Note that when the first subfield in a tag does not carry a subfield code, it is interpreted as subfield "a."

When these records are in LC/MARC or OCLC/MARC format, substantial documentation is available from LC or OCLC to describe the contents of fixed and variable fields. When these records are not in the LC/MARC or OCLC/MARC format, the libraries themselves have to provide documentation to describe the format of their records and/or format deviations from the LC/MARC or OCLC/MARC format.

The OCLC/MARC record in fig. 7 was obtained from the database in the OCLC online cataloging subsystem. Not all of the information detailed in a MARC record is necessary for subject searching by library users in an online catalog. Thus, we selected fields and subfields of a MARC record to make up the database of the experimental online catalog.

4.3 Selection of Machine-readable Data from the DDC for DOC Subject Searching

4.3.1 Introduction

This section describes how we manipulated the DDC Schedules and Relative Index to produce essential and desired information for the Dewey Online Catalog (DOC). This information had to be manipulated to get rid of undesirable characters, such as subfield codes and typesetting and printing characters.

4.3.2 DDC Schedules

Inforonics, Inc., provided us with magnetic tapes containing portions of the DDC Schedules in the four subject areas selected by the four participating libraries. In fig. 8, a few DDC Schedule records are shown in a machine-readable format.

A Schedule record starts with a field named index sequential number (isq) and ends with two slashes (//). Each record contains a variable number of fields, each preceded by a two- or three-letter tag. The fields that have the tags starting with the letter "n" are called collectively DDC Schedule notes.

Every Schedule record used in the DDC Online Project contains at least five fields: (1) index sequential number (isq) defined as a system-supplied unique number for record deletion and replacement; (2) record number (rno) defined as a number assigned to each record as it enters the Inforonics' editorial database for the DDC; (3) main entry (me) defined as the classification number or range that the rest of the record describes; (4) main entry text (met) defined as the caption or heading that describes the meaning of the last significant digit of the classification number expressed in the record's me field; and (5) Schedule record from full edition indicator (srf) defined as a system-supplied message to indicate the DDC section (i.e., Table, Schedule, Index) and edition from which the Schedule record comes. There are twenty-three different types of notes and five different types of footnotes in the DDC Schedules. Definitions and examples of fields in Schedule records and special characters for printing and typesetting are provided in appendix A. Explanations of Schedule notes and footnotes are provided in appendix B.

```
isq840313103322962
rno70229500
me796.5
metOutdoor life
srfSchedule-Full Ed.
//

isq840313103322970
rno70229600
me796.51
metWalking
nch@rClass here backpacking
ncr@xFor walking in specific kinds of terrain, see 796.52
srfSchedule-Full Ed.
//

isq840313103322987
rno70229700
me796.52
metWalking and exploring in various specific kinds of terrain
srfSchedule-Full Ed.
//

isq840313103322995
rno70229800
me796.522
metMountains, hills, rocks
srfSchedule-Full Ed.
//

isq840313103323001
rno70229900
me796.522 3
metRock climbing
srfSchedule-Full Ed.
//

isq840313103323018
rno70230000
me796.525
metCaves
not@rSpelunking
srfSchedule-Full Ed.
//
```

Fig. 8. DDC Schedule records in a machine-readable format
(cont. on next page)

```
isq840313103323026
rno70230100
me796.53
metBeach activities
ncr@xFor aquatic sports, see 797.1‡797.2
srfSchedule-Full Ed.
//

isq840313103323034
rno70230200
me796.54
metCamping
srfSchedule-Full Ed.
//

isq840313103323042
rno70230300
me796.542
metKinds of camps
nch@rClass here camps operated for profit
nce@rClass activities in specific kinds of camps in 796.545
srfSchedule-Full Ed.
//
```

Fig. 8. DDC Schedule records in a machine-readable format (continued)

The first two columns of table 1 are labeled "Tag" and "Tag Name" and contain all fields in an Inforonics-produced Schedule record. The third column, "DOC Schedule Record," lists the ten fields selected for indexing (designated by I) and/or display (designated by D) in the Dewey Online Catalog. Six of these fields--main entry (class number), main entry text (class number caption), example notes, including notes, class here notes, and general notes--were selected by project participants in a meeting at the beginning of the DDC Online Project as being subject-rich fields in a Schedule record (see section 3.2). The four remaining fields were selected by the DDC Online Project team, with help from the Decimal Classification Division, to direct users from unused, formerly used, or not preferred class numbers to other acceptable class numbers. The fourth column, "DOC Bibliographic Record," contains the five subject-rich fields in DDC Schedule records that are added to bibliographic records whenever the class number in a bibliographic record matches the class number in a Schedule record. Although the contents of these five fields are added to bibliographic records, the contents of only the met (main entry text) field is displayed in bibliographic records because Schedule notes describe the subject matter of books that are classed in an area but do not necessarily describe the contents of any one book. In sections 4.3.2.1-4.3.2.5, the manipulation of DDC Schedule records to produce essential and desired information for indexing and/or display in DOC is described.

Table 1. Fields in Machine-readable DDC Schedule Records Selected for Indexing and Display in DOC

Tag	Tag Name	DOC Schedule Record	DOC Bibliographic Record
me	main entry or DDC class number	Location (or Area) (I,D)	Schedules DDC Class Number (I)
met	main entry text or DDC caption	Topic (I,D)	DDC Caption (I,D)
ch	centered heading		
cht	centered heading text		
smh	summary heading		
smn	summary number		
nsn	new schedule notes		
npx	Phoenix schedule notes		
nex	examples notes	Example Notes (I,D)	DDC Notes (I)
nph	former heading		
nin	including notes	Including Notes (I,D)	DDC Notes (I)
nch	class here notes	Class Here Notes (I,D)	DDC Notes (I)
nlp	alphabetic arrangement notes		
nop	optional provisions notes	Optional Notes (D)	
nst	standard subdivisions table notes		
nsx	standard subdivisions exceptions note	Exception Notes (D)	
nxz	use of more than one zero for standard subdivisions table notes		
nad	add notes		
nco	citation notes		
ndn	discontinued numbers and topics notes	Discontinued Notes (D)	
nrl	relocation notes	Relocation Notes (D)	
nru	most recent use notes		
nce	class elsewhere notes		
ncr	cross-reference notes		
nit	introduction to table notes		
not	other types of notes	General Notes (I,D)	DDC Notes (I)
nsa	see also notes		
nfa	add as instructed under footnotes		
nfc	class as instructed under footnotes		
nfo	option footnotes		
nfz	use of more than one zero in standard subdivisions footnotes		
nfx	other types of footnotes		
srf	Schedules record from library edition indicator		
rno	record number		
isq	index sequential number		

I = Indexed field in a DOC Schedule or bibliographic record
D = Displayed field in a DOC Schedule or bibliographic record

4.3.2.1 Not Used DDC Captions

The DDC captions in brackets (i.e., the captions that are not in use, not recommended for use, or no longer used in the 19th edition of the DDC Schedules) are ignored. For example, the class number 517 is accompanied by the term "[Unassigned]" and is enclosed in brackets. This class number is ignored and not used for indexing and/or display in DOC. Therefore, only valid captions in the 19th edition of the DDC are used in this project.

4.3.2.2 Ranges of DDC Numbers

In DOC, the DDC Schedules were displayed as a collection of individual DDC class numbers. Thus, a range of DDC numbers was expanded to individual Schedule records bearing unique DDC class numbers and the same DDC caption and notes. For example, this range in the Schedules--330.91-.99 Geographical treatment (Economic geography)--became nine separate DDC numbers and captions:

330.91	Geographical treatment (Economic geography)
330.92	Geographical treatment (Economic geography)
330.93	Geographical treatment (Economic geography)
330.94	Geographical treatment (Economic geography)
330.95	Geographical treatment (Economic geography)
330.96	Geographical treatment (Economic geography)
330.97	Geographical treatment (Economic geography)
330.98	Geographical treatment (Economic geography)
330.99	Geographical treatment (Economic geography)

In DOC, each class number and caption were also accompanied by the number of items in the database bearing the listed class number.

4.3.2.3 Dummy DDC Class Numbers and Captions

The DDC is based on decimal numbers from 0 to 9. In DOC, we used the classification notation to display a list of class numbers and captions in which the listed class numbers and captions were on the same level of the DDC hierarchy. These lists were not necessarily made up of ten class numbers and captions. In the example below, there are no class numbers or captions in the Schedules for 796.331, 796.337, 796.338, and 796.339.

796.332	American football
796.333	Rugby
796.334	Soccer (Association football)
796.335	Canadian football
796.336	Australian-rules football

Furthermore, not every class number and caption in the list above leads to a more specific number and caption. But every class number and caption in the list above does lead to a more general class number and caption. For example, "796.332 American football" leads to the more general caption "796.33 Inflated ball driven by foot." However, this is not true when a DDC number has embedded zeros because, according to the nature of the DDC system, a DDC class number ending with a zero is meaningless. For example, the caption under 796.33206 is

"Organizations, facilities, management," but 796.3320 means nothing and is not listed in the DDC Schedules. Thus, we needed a means to automatically generate lists of DDC class numbers and captions on the same level of the DDC hierarchy. We could not just truncate the last digit of a valid DDC class number and expect that the result would be a valid class number. Therefore, dummy DDC class numbers with trailing zeros and the caption "General aspects. Examples: Journals, study and teaching" were added to the DDC Schedules in DOC. For example, we added the dummy DDC class number 796.3320 with the caption "General aspects. Examples: Journals, study and teaching" to enable a user to proceed down into the DDC hierarchy to display the class number and caption and retrieve items with the class number 796.33206 in the DDC Schedules.

4.3.2.4 Replaced Phrases

Some of the terms and phrases used in the DDC Schedules are easily understood by classifiers but may confuse DOC users. They have been replaced with understandable common words. The phrase "Class here" in the class here notes is replaced with the word "Also." For example, the class here note under the class number 796.542, "Class here camps operated for profit," now reads "Also camps operated for profit" in DOC.

With the assistance of the Decimal Classification Division, we changed captions of DDC numbers bearing the phrase "Standard subdivisions" under 330.02-330.08, 333.002-333.009, 336.001-336.008, 336.2001-336.2008, 338.002-338.008, 338.9001-338.9008, 380.103-380.109, and 658.003-658.009 as follows:

Last digit:	Caption:
1	Philosophy and theory
2	Miscellany
3	Dictionaries and encyclopedias
4	(not found)
5	Serial publications
6	Organizations and management
7	Study and teaching
8	With respect to groups of persons
9	From a historical and geographical viewpoint

Without this change, LC users would have been directed to outlines of DDC Schedule captions solely composed of the phrase "Standard subdivisions." PLCFC searchers had found such outlines confusing in online retrieval tests, which preceded the online retrieval tests at LC. Thus, we made this change to captions in the experimental online catalog for the Library of Congress.

Standard subdivisions exceptions notes, discontinued numbers and topics notes, relocation notes, and optional provisions notes were added to DOC to direct users to valid 19th edition class numbers from previously used, unused, or not preferred class numbers. We added the phrase "See xxx.xx, Using Call Number Search" to these notes, where "xxx.xx" is the valid DDC class number.

4.3.2.5 Eliminated Characters

All diacritics and typesetting characters in the DDC Schedules were eliminated.

4.3.2.6 Schedule Records in DDC

Table 2 shows the number of Schedule records received from Inforonics and the number of Schedule records processed into DDC. The number of Schedule records processed into DDC is equal to or higher than the number of Schedule records received from Inforonics because (1) Schedule records containing ranges were expanded into individual Schedule records (see 4.3.2.2) and (2) dummy Schedule records with trailing zeros were added to enable users to proceed down into the DDC hierarchy to display Schedule information and retrieve items whose class numbers contained a zero after the decimal point (see 4.3.2.3).

Table 2. DDC Schedule Records Received and Processed

	LC	NYSL	PLCFC	UI
Number of DDC Schedule records received from Inforonics	1,171	179	529	282
Number of DDC Schedule records processed into DDC	1,714	183	725	287

4.3.3 DDC Relative Index

Inforonics, Inc., provided us with magnetic tapes containing portions of the DDC Relative Index in the four subject areas selected by the four participating libraries. In fig. 9, a few DDC Relative Index records are shown in a machine-readable format.

A Relative Index record starts with a field named index sequential number (isq) and ends with two slashes (//). Each record contains a variable number of fields each preceded by a three-letter tag.

Every Relative Index record used in the DDC Online Project contains at least five fields: (1) index sequential number (isq) defined as a system-supplied unique number for record deletion and replacement; (2) record number (rno) defined as a number assigned to each record as it enters Inforonics' editorial database for the DDC; (3) index text, first level (ixa), defined as the textual description of the main index entry; (4) numeric reference for index text (ixn) defined as the DDC Schedule number to which the index text refers; and (5) index record from full edition indicator (irf) defined as a system-supplied message to indicate the DDC section (i.e., Table, Schedule, Index) and edition from which the Relative Index record comes.

```
isq8404130203209306
rno510930
ixaOutdoor
ixblife
ixcsports
ixn796.5
irfIndex-Full Ed.
//

isq840413024374617
rno807461
ixaWalking (sports)
ixbrecreation
ixn796.51
irfIndex-Full Ed.
//

isq840413014917438
rno401743
ixaHikers
ixbbiog. & work
ixn796.510 92
irfIndex-Full Ed.
//

isq840413013174236
rno307423
ixaExplorations
ixbrecreation
ixn796.52
irfIndex-Full Ed.
//

isq840413014917527
rno401752
ixaHill
ixbclimbing
ixcsports
ixn796.522
irfIndex-Full Ed.
//

isq840413020357576
rno505757
ixaMountain
ixbclimbing
ixcsports
ixn796.522
irfIndex-Full Ed.
//
```

Fig. 9. DDC Relative Index records in a machine-readable format

There are no subfields in Relative Index records. Secondary Relative Index entries, i.e., entries indented under the Main Relative Index entry, are represented with their own unique three-letter tag beginning with the tag ix and ending in letters b, c, d, e, f, g, or h. This allows a secondary Relative Index entry indented seven times below the main Relative Index entry to be expressed in the machine-readable format. For example, the index text of a Relative Index entry that contains two secondary Relative Index entries, and two indentions,

Camping
equipment
armed forces 355.81

is expressed in a machine-readable Relative Index record as

ixaCamping
ixbequipment
ixcarmed forces.

In the processing of machine-readable Relative Index entries, main Relative Index entries are concatenated to the secondary entries and separated by two hyphens; secondary entries are concatenated to other secondary entries and separated by two hyphens. Thus, the Relative Index entry becomes

Camping--equipment--armed forces.

Definitions of fields in Relative Index records are provided in appendix C.

The first two columns of table 3, "Tag" and "Tag Name," contain all the fields in an Inforonics-produced Relative Index record. The third column, "DOC Relative Index Record," contains the nine fields selected for indexing (designated by I) and/or display (designated by D) in a subject search of the Relative Index in DOC. The fourth column, "DOC Bibliographic Record," shows the eight subject-rich fields in DDC Relative Index records that are added to the bibliographic record whenever the class number in a bibliographic record matches the class number in a Relative Index record. Although the contents of these eight fields are added to bibliographic records, none of these eight fields are displayed in bibliographic records because Relative Index entries describe the subject matter of books that may be classed in an area but do not necessarily describe the contents of any one book. (See also section 4.4.3.6.) The fifth column of table 2, "DOC Schedule Record," shows the eight subject-rich fields in DDC Relative Index records that are added to a DOC display of DDC class numbers, captions, and notes in DDC Schedule records. Sections 4.3.3.1-4.3.3.3 describe the manipulation of DDC Relative Index records to produce essential and desired information for indexing and/or display in DOC.

Table 3. Fields in Machine-readable DDC Relative Index Records Selected for Indexing and Display in DOC

Tag	Tag Name	DOC Relative Index Record	DOC Bibliographic Record	DOC Schedule Record
ixa	index text (1st level)	Topics--Aspects (I,D)	Dewey Index (I)	Dewey Index (I,D)
ixb	index text (2d level)	Topics--Aspects (I,D)	Dewey Index (I)	Dewey Index (I,D)
ixc	index text (3d level)	Topics--Aspects (I,D)	Dewey Index (I)	Dewey Index (I,D)
ixd	index text (4th level)	Topics--Aspects (I,D)	Dewey Index (I)	Dewey Index (I,D)
ixe	index text (5th level)	Topics--Aspects (I,D)	Dewey Index (I)	Dewey Index (I,D)
ixt	index text (6th level)	Topics--Aspects (I,D)	Dewey Index (I)	Dewey Index (I,D)
ixg	index text (7th level)	Topics--Aspects (I,D)	Dewey Index (I)	Dewey Index (I,D)
ixh	index text (8th level)	Topics--Aspects (I,D)	Dewey Index (I)	Dewey Index (I,D)
ixn	numeric reference for index text	Location or Area (I)		
ixr	cross-reference from index text			
xxx	sort point			
rno	record number			
isq	index sequential number			
irf	index record from full edition indicator			

I = Index field in DOC
D = Displayed field on DOC

4.3.3.1 Not Used DDCRI Entries

The DDC class number in the DDC Relative Index is a link from the DDC Relative Index to the Schedules. That is, a DDC Relative Index entry must direct a user to a valid class number in the Schedules. However, there are Relative Index entries that do not direct one to a class number and caption listed in the DDC Schedules.

For example, the DDC Relative Index entry "Slide-rule mathematics" has the DDC class number 510.28, but this class number does not exist in the Schedules. We designed the experimental online catalog so that the user can always access the DDC Schedules from any entry in the Relative Index, which is possible only if every DDC number that exists in the Relative Index also exists in the Schedules. Therefore, all DDC Relative Index entries whose DDC numbers did not match a class number in a DDC Schedules record were eliminated.

4.3.3.2 Abbreviations

Nearly every other entry in the Relative Index of the 19th edition of DDC contains an abbreviation. While abbreviations are easily understood by online searchers reading displayed information, abbreviations cannot be indexed for searching in a meaningful way. Every abbreviation was completely spelled out, whether the abbreviation was expressed by one or more words. When an abbreviation could be replaced by only one word or phrase, the replacement was done automatically by the computer.

For example, the abbreviation "cent." was always replaced by "century." When the abbreviation was expressed by two or more words or phrases, the replacement was done manually. For example, the abbreviation "clim." could be replaced by "climate," "climates," "climatological," or "climatology." Relative Index entries containing the abbreviation "clim." had to be read by a DDC Online Project team editor and changed to its unabbreviated form according to the editor's understanding of the abbreviation in the context of the entire Relative Index entry.

4.3.3.3 Eliminated Characters

All diacritics in the Relative Index were eliminated in DOC.

4.3.3.4 Relative Index Records in DOC

Table 4 shows the number of Relative Index records received from Inforonics and the number of Relative Index records processed into DOC. The number of Relative Index records processed into DOC is equal to or lower than the number of Relative Index records received from Inforonics because (1) Relative Index entries whose DDC numbers did not match a class number in a DDC Schedules record were eliminated (see 4.3.3.1), and (2) Relative Index entries whose DDC numbers did not match a class number in a participating library's bibliographic records were eliminated.

Table 4. DDC Relative Index Records Received and Processed

	LC	NYSL	PLCFC	UI
Number of DDC Relative Index records received from Inforonics	2,162	228	1,345	753
Number of DDC Relative Index records processed into DOC	1,956	228	1,014	706

4.4 Selection of Machine-readable Data from Bibliographic Records

4.4.1 Introduction

The OCLC/MARC communications format was studied for the selection of fields for indexing and display in the experimental online catalog. The DDC Online Project team consulted lists of indexed fields and subfields compiled by Mankato State University (and accessible to Mankato State online catalog users through the entry of the "HELP INDEX" command), by Markey (1984, 158-62), and by OCLC Local Systems Division staff for profiling libraries' bibliographic records in

LS/2000. As fields and subfields were selected, it was necessary to identify the type of index into which the field and subfield data would be processed and the name of the field and subfield data that would be displayed in bibliographic records.

In sections 4.4.2 and 4.4.3, the selection of data from participating libraries' bibliographic records is featured. Bibliographic data selected for indexing and display were processed into the databases of SOC and DOC. Each participating library's records were separately processed, i.e., bibliographic records from participating libraries were not mixed together. Thus, there were four separate Subject Online Catalogs (one SOC per participating library) and four separate Dewey Online Catalogs (one DOC per participating library).

4.4.2 Selection of Machine-readable Data from Bibliographic Records for SOC

The database of the Subject Online Catalog was made up of data from a single source: each library's bibliographic records. Table 5 lists the fields and subfields of a MARC format record that were selected for inclusion in SOC.

The columns of table 5 are the following:

Field:	A general description of the contents of fields and subfields listed by their alphanumeric tags and subfields labels in the column entitled "Source."
Source:	MARC fields and subfields of a bibliographic record selected for inclusion in SOC.
Display in Bibliographic Records:	The name of a field in a SOC bibliographic record display.
Search:	The type of subject search that accesses the contents of the listed fields and subfields (see section 5.2).
Notes:	The library for which this SOC field is specially created.

Field tags, numeric indicators, and end-of-field delimiters were deleted from SOC records. Subfield labels, e.g., b, x, y, z, were eliminated in displays of bibliographic records and replaced with one blank space. For example, "260 0 New York: ‡b Scholastic Book Services ‡c c1981¶" became "New York: Scholastic Book Services, c1981." However, in MARC fields 600 to 695, subfield labels were replaced with two hyphens. For example, "651 0 United States ‡x Economic policy ‡y 1971-" became "United States--Economic Policy--1971-."

Table 5. Fields in a SOC Bibliographic Record

Field	Source	Display in Bibliographic Records	Search	Notes
DDC call number	099a or 092a,b or 082a	CALL NUMBER	n/a	UI,PLCFC
	992a,b	CALL NUMBER	n/a	NYSL
	082a	DEWEY NUMBER	n/a	LC
Library DDC class number	DDC call number	n/a	SC	*
LC call number	050a,b,d	CALL NUMBER	n/a	LC
Collection	998a	COLLECTION	n/a	NYSL
Title	245a,b,n,p	TITLE	SD	
Alternate title	130a,t,n,p,s	ALTERNATE TITLE	SD	
	240a,p,s			
	241a			
	242a,b			
	730a,p,s			
Title added	740a,b	n/a	SD	
LC subject	600a,q,b,c,d,x,y,z	LC SUBJECT	SD,SA	*
	610a,b,n,d,c,x,y,z			
	611a,q,b,n,d,c,e,x,y,z			
	630a,t,n,p,s,x,y,z			
	650a,b,x,y,z			
	651a,b,x,y,z			
	652x,y,z			
	690a,b,x,y,z			
	691a,b,x,y,z			
	692a,x,y,z,b,c			
	693a,b,x,y,z			
	694a,b,q,n,d,c,e,x,y,z			
	695a,n,p,s,x,y,z			
Genre	655a,x,y,z	n/a	SD	
Subheading	700t	n/a	SD	
	710t			
Contents	505a	CONTENTS	SD	
	520a			
Author	100a,q,b,c,d	AUTHOR	n/a	

*Contents of this field are not indexed or searched in the same way in SOC and DOC (see chapter 5).

Table 5. Fields in a SOC Bibliographic Record (continued)

Field	Source	Display in Bibliographic Records	Search	Notes
Author (cont.)	110a,q,b,n,d,c 700a,q,b,c,d 710a,q,b,n,d,c			
Sponsor	111a,q,b,n,d,c 711a,q,b,n,d,c	SPONSOR	SD	
Edition	250a	EDITION	n/a	
Publisher	260a,b,c	PUBLISHER	n/a	
Series	440a,p 490a	SERIES	SD	
Series title	400t 410t 411t	n/a	SD	
Series added	830a,p	n/a	SD	

The fields that are specially constructed for SOC are the DDC call number, Library DDC class number, and LC subject.

4.4.2.1 DDC Call Number

The contents of the DDC call number field are generated from different MARC tags and subfields for different libraries: tag 099 subfield a, or tag 092 subfields a and b, or tag 082 subfield a for University of Illinois and for the Public Library of Columbus and Franklin County; tag 992 subfields a and b for New York State Library; tag 082 subfield a for Library of Congress. Slashes in the DDC call numbers for LC are removed.

4.4.2.2 Library DDC Class Number

This library DDC class number is created from the DDC call number. The library DDC class number is the numeric portion of the DDC call number. For example, if the DDC call number is 796.54STI, then the Library DDC class number is 796.54. This DDC class number is called Library DDC call number because it was the class number assigned by the library staff. It is different from the Schedules DDC class number in DOC which is discussed in the section 4.4.3.2.

4.4.2.3 LC Subject

When searching SOC (see section 5.2), users browse a list of ten alphabetically arranged subject headings at a time. In a test load of about two-hundred records from our participating libraries, we found many spelling and typographical errors. We felt that such errors would have an adverse effect on recall in the online retrieval tests with library patrons and staff. Thus, misspelled subject headings and headings with typographical errors were manually corrected in the bibliographic records from all four participating libraries.

4.4.2.4 SOC Bibliographic Record Display

In fig. 10, an example of a bibliographic record display in SOC is provided. This bibliographic record was created from the MARC record in fig. 7 using the procedures described in this section (4.4.2).

CALL NUMBER	796.54STI
TITLE	The cool kids guide to summer camp.
LC SUBJECT	Camps
AUTHOR	Stine, Jovial Bob. Stine, Jane. Zimmerman, Jerry.
PUBLISHER	New York: Scholastic Book Services, c1981
SERIES	Vagabond Books

Fig. 10. SOC bibliographic record display

4.4.3 Selection of Machine-readable Data from Bibliographic Records for DOC

The database of the Dewey Online Catalog was made up of data from three sources: (1) bibliographic records, (2) DDC Schedules, and (3) DDC Relative Index. In table 6, the MARC format record fields and subfields selected for inclusion in DOC are listed.

The columns of table 6 are the following:

Field:	A general description of the contents of fields and subfields listed by their alphanumeric tags and subfield labels in the column entitled "Source."
Source:	MARC fields and subfields of a bibliographic record selected for inclusion in DOC.
Display in Bibliographic Records:	The name of a field in a DOC bibliographic record display.
Search:	The type of subject search that accesses the contents of the listed fields and subfields (see section 5.3).
Notes:	The library for which this DOC field is specially created.

Field tags, numeric indicators, and end-of-field delimiters were deleted from DOC records. Subfield labels, e.g., b, x, y, z, were eliminated in displays of bibliographic records and replaced with one blank space. For example, "260 0 New York: ‡b Scholastic Book Services ‡c c1981¶" became "New York: Scholastic Book Services, c1981." However, in MARC fields 600 to 695, subfield labels were replaced with two hyphens. For example, "651 0 United States ‡x Economic policy ‡y 1971-" became "United States--Economic policy--1971-."

Table 6. Fields in a DOC Bibliographic Record

Field	Source	Display in Bibliographic Records	Search	Notes
DDC call number	099a or 092a,b or 082a	CALL NUMBER	n/a	UI,PLCFC
	992a,b	CALL NUMBER	n/a	NYSL
	082a	DEWEY NUMBER	n/a	LC
Schedules DDC class number	DDC call number	n/a	SC	*
LC class number	050a,b,d	CALL NUMBER	n/a	LC
Collection	998a	COLLECTION	n/a	NYSL
Title	245a,b,n,p	TITLE	SD	
Alternate title	130a,t,n,p,s 240a,p,s 241a 242a,b 730a,p,s	ALTERNATE TITLE	SD	
Title added	740a,b	n/a	SD	
LC subject	600a,q,b,c,d,x,y,z 610a,b,n,d,c,x,y,z 611a,q,b,n,d,c,e,x,y,z 630a,t,n,p,s,x,y,z 650a,b,x,y,z 651a,b,x,y,z 652x,y,z 690a,b,x,y,z 691a,b,x,y,z 692a,x,y,z,b,c 693a,b,x,y,z 694a,b,q,n,d,c,e,x,y,z 695a,n,p,s,x,y,z	LC SUBJECT	SD,SS	*
Genre	655a,x,y,z	n/a	SD	
Subheading	700t 710t	n/a	SD	
DDC caption	DDC Schedules	DEWEY SUBJECT	SD,SS	*
DDC notes	DDC Schedules	n/a	SD,SS	*

*Contents of this field are not indexed or searched in the same way in SOC and DOC (see chapter 5).

Table 6. Fields in a DDC Bibliographic Record (continued)

Field	Source	Display in Bibliographic Records	Search	Notes
DDC Relative Index entry	DDC Relative Index	n/a	SD,SS,SA	*
Contents	505a 520a	CONTENTS	SD	
Author	100a,q,b,c,d 110a,q,b,n,d,c 700a,q,b,c,d 710a,q,b,n,d,c	AUTHOR	n/a	
Sponsor	111a,q,b,n,d,c 711a,q,b,n,d,c	SPONSOR	SD	
Edition	250a	EDITION	n/a	
Publisher	260a,b,c	PUBLISHER	n/a	
Series	440a,p 490a	SERIES	SD	
Series title	400t 410t 411t	n/a	SD	
Series added	830a,p	n/a	SD	

The fields that are specially constructed for DDC are the DDC call number, Schedules DDC class number, LC subject, DDC caption, DDC notes, and DDC Relative Index entry.

4.4.3.1 DDC Call Number

The contents of the DDC call number field are from different MARC tags and subfields for different libraries: tag 099 subfield a, or tag 092 subfields a and b, or tag 082 subfield a for University of Illinois and for the Public Library of Columbus and Franklin County; tag 992 subfields a and b for New York State Library; tag 082 subfield a for Library of Congress. Slashes in the DDC call numbers for LC are removed.

4.4.3.2 Schedules DDC Class Number

A Schedules DDC class number of a bibliographic record is defined as a DDC class number that exists in the Schedules and is the best match of the record's DDC call number (when the DDC call number is defined according to table 6). For example, a bibliographic record with the DDC call number 510.3 also has 510.3 as the Schedules DDC class number, since 510.3 is in the DDC Schedules and is identical to the DDC call number. A bibliographic record with the DDC call number 332.7430202 has 332.743 as the Schedules DDC class number because 332.743 exists in the DDC Schedules and is the best match of 332.7430202; a better match is 332.7430202, 332.743020, 332.74302, or 332.7430, but these class numbers are not in the Schedules. Therefore, a Schedules DDC class number is either the DDC call number itself or a truncated version of the number which is the best match of the DDC call number in the 19th edition of the DDC Schedules.

The reason why the DDC call number 332.7430202 is not in the DDC Schedules is because this class number is a synthesized number, i.e., the number is composed from the DDC Schedules and Tables. The data used in the DDC Online Project are confined to the DDC Schedules and Relative Index (see section 3.4). This technique of finding the best match of DDC class numbers in the Schedules is the result of this project's limitation to the DDC Schedules and Relative Index. The Schedules DDC class numbers are also used to match a valid number in an earlier DDC edition with a valid number in the 19th edition of the DDC Schedules. For example, 796.33285 used to be a valid DDC number in a DDC edition prior to the current 19th edition. The best match of the old number, 796.33285, is 796.332 in the 19th edition of DDC. DOC will automatically assign the Schedules DDC class number 796.332 to a bibliographic record bearing the old number 796.33285.

The Schedules DDC number is necessary for the call number search in DOC. The Schedules DDC number is also used to match the class number in the DDC Schedules and Relative Index in order to add Schedules information and Relative Index entries to the bibliographic record.

Typing errors and misspelling can occur anywhere in a bibliographic record. Class numbers mistakes are especially harmful in the experimental online catalog developed in the DDC Online Project because bibliographic records are augmented with a Schedules DDC class number and DDC captions and Relative Index entries based on matching DDC numbers in the bibliographic records. When the DDC call number is wrong, the Schedules DDC class number, DDC captions, and DDC Relative Index entries automatically augmented to records are erroneous. For example, a book on horse racing mistakenly classed under 796.4 (instead of 798.4) is automatically assigned the Schedules DDC class number 796.4 (instead of 798.4), DDC captions "Athletic and outdoor sports and games" and "Athletic exercises and gymnastics" found under DDC class numbers 796 and 796.4, respectively, (instead of "Equestrian sports and animal racing" and "Horse racing" found under DDC class numbers 798 and 798.4, respectively), and DDC Relative Index entry "Athletic--exercises--sports" (instead of "Horse--racing--sports).

Errors in DDC classification numbers negatively affect all searches in DOC. In order to eliminate this problem, the errors have to be identified and corrected. The Project Team decided not to correct these errors for the following reasons: (1) identifying the errors is very time-consuming and not sufficiently foolproof; (2) correcting the errors requires intensive writing of new software to provide SOC and DOC with a local cataloging function; and (3) the time and effort spent on identifying and correcting the errors may not be justified because there may actually be very few errors at the present time and still be unidentified errors in the database at the end of a correction process.

4.4.3.3 LC Subject

When searching DOC (see section 5.3), users do not browse a list of alphabetically arranged subject headings, but they are able to retrieve bibliographic records in keyword searches that search bibliographic records' subject heading fields. In a test load of about two-hundred records from our participating libraries, we found many misspelled subject headings and headings with typographical errors. We felt that such errors would have an adverse effect on recall in the online retrieval tests with library patrons and staff. Thus, misspelled subject headings and headings with typographical errors were manually corrected in the bibliographic records from all four participating libraries.

4.4.3.4 DDC Caption

Each bibliographic record in DOC is enhanced with two DDC captions or headings from the DDC Schedules. The selection of these two headings is as follows: (1) the first caption (listed in the Dewey Subject field of DOC bibliographic records) is taken from the DDC Schedules where the Schedules DDC class number with its last digit truncated matches the class number in the DDC Schedules; and (2) the second caption (listed in the Dewey Subject field of bibliographic records) is taken from the DDC Schedules where the Schedules DDC class number matches the class number in the DDC Schedules. For example, a bibliographic record with Schedules DDC class number 796.54 is enhanced with the caption "Outdoor life," found at 796.5 in the DDC Schedules, and with the caption "Camping," found at 796.54 in the DDC Schedules. If the Schedules DDC class number is only three digits long, then only one DDC caption is added to the bibliographic record. For example, a bibliographic record with the Schedules DDC Class Number 790 is enhanced with the caption "Recreational and performing arts," found at 790 in the DDC Schedules.

4.4.3.5 DDC Notes

The selection of DDC notes is the same as that of DDC captions: the DDC notes are chosen based on the Schedules DDC class number and the Schedules DDC class number with the last digit truncated. There are many class numbers in the DDC Schedules that do not have notes; consequently, not all bibliographic records in DOC are enhanced with notes from the DDC Schedules. As specified in table 1, only four types of DDC notes are added to bibliographic records: example notes, including notes, class here notes, and general notes.

4.4.3.6 DDC Relative Index Entries

A bibliographic record is enhanced with DDC Relative Index entries using the Schedules DDC class number. Sometimes there are no Relative Index entries directing a user to a class number in the Schedules, and sometimes there is one or more. Thus, bibliographic records might have zero, one, or more Relative Index entries. For example, a bibliographic record with Schedules DDC class number 796.54 (Outdoor life. Camping.) is augmented with the DDC Relative Index entry "Camping--sports" (see fig. 11); a bibliographic record with Schedules DDC class number 336.291 (for General principles of taxation) has no Relative Index entries.

```
CALL NUMBER          796.54STI
TITLE                The cool kids guide to summer camp
LC SUBJECT           Camps
DEWEY SUBJECT        Outdoor life. Camping.
AUTHOR               Stine, Jovial Bob
                     Stine, Jane
                     Zimmerman, Jerry
PUBLISHER            New York: Scholastic Book Services, c1981
SERIES               Vagabond Books
```

Fig. 11. DDC bibliographic record display

When more than one DDC Relative Index entry is added to a bibliographic record, not all of the entries need apply to the content of the book represented by the bibliographic record. For example, there are three Relative Index entries for the DDC number 658.15224: "Bonds (Securities) issues--capital management," "Borrowing capital sources--capital management," and "Stock issues--capital sources," but a book bearing this DDC class number may be on stocks and not bonds. This is why the field bearing Relative Index entries is not displayed in the bibliographic record.

The book represented by the bibliographic record below contains information on residents of the town of Manlius in New York State. There are two Relative Index entries whose class number matched the class number of this record, viz., "Onondaga County New York--history" and "Skaneateles Lake New York--history." The second of the two Relative Index entries clearly does not apply to this book's contents because it describes a lake forty miles east of Manlius, N.Y. in the town of Skaneateles! If Relative Index entries were displayed in this record, a user who retrieves this record and later selects this book from the bookshelves would probably be discouraged by his selection because this book does not contain information on Skaneateles Lake.

```
DEWEY NUMBER           974.765qM27m2
COLLECTION             H
TITLE                  World War I [roll of...men at front] township of Manlius,
                       Onondaga County...Copied by the Mediceans Club.
LC SUBJECT             European war, 1914-1918--Registers, lists, etc.
DEWEY SUBJECT          History of North central counties.  History of Onondaga
                       County.
SPONSOR                Manlius, N.Y. Methodist Church.
                       Mediceans Club, Manlius (?) N.Y.
PUBLISHER              1960
```

4.4.3.7 DDC Bibliographic Record Display

Fig. 11 is an example of a display of a bibliographic record in DOC. This bibliographic record was created from the MARC record in fig. 7 and DDC information in the Schedules and Relative Index using the procedures described in this section. When compared with the record in SOC (see fig. 10), the DOC record in fig. 11 has an additional field called "Dewey Subject" in which captions from the DDC Schedules are displayed. Records have been enhanced with one or more Relative Index entries and/or notes from the Schedules, but this information is indexed and not displayed in bibliographic records.

4.4.4 Bibliographic Records in SOC and DOC

The four participating libraries submitted between 8,000 and 15,000 bibliographic records to the DDC Online Project in the one of four subject areas selected by the library. Unfortunately, preliminary processing of these records showed that not all records had class numbers in the subject area selected by the library and that there were duplicate records.

To ensure that all the records would be in the correct subject areas, we selected MARC records based on the following criterion: the MARC record is accepted only if its DDC class number or derived truncated DDC class number exists in the DDC Schedules selected by that library. For example, the LC database must contain records in Schedule class numbers 330-339, 380-382, or 658 only. A MARC record with DDC number 519.5 is not acceptable because it is outside the subject area for LC. A bibliographic record with DDC number 658.3 is acceptable because it is enumerated in the DDC Schedules and is within 658. A bibliographic record with DDC number 332.7430202 is acceptable because its truncated number, 332.743, is enumerated in the Schedules and is within 330-339; however, its exact number, 332.7430202, is not enumerated in the DDC Schedules.

Other records eliminated in this selection process were duplicate or erroneous records. Duplicate records are those with nonunique DDC call numbers; there were over four-hundred such records from the UI collection. An example of an erroneous record is one without a DDC class number.

Table 7 shows the number of bibliographic records received from the four participating libraries and the number of bibliographic records processed into SOC and DOC. The number of bibliographic records processed into SOC and DOC is equal to or less than the number of records received from participating libraries, since records bearing class numbers outside the subject area chosen by the library for study in this project and duplicate and erroneous records were excluded.

Table 7. Bibliographic Records Received and Processed

	LC	NYSL	PLCFC	UI
Number of bibliographic records received from each participating library	11,873	8,169	9,719	14,949
Number of bibliographic records processed into SOC and DOC	11,865	8,144	9,719	7,603

4.5 Summary

This chapter described the selection of subject and other information from the three data sources used to develop the experimental online catalog: (1) libraries' bibliographic records, (2) DDC Relative Index, and (3) DDC Schedules. SOC's source of subject and other information was solely from libraries' bibliographic records, whereas DOC's sources of subject and other information were from all three sources.

Fields in DDC Schedules and Relative Index records were identified and described and the fields whose contents were processed into DOC Schedule, Relative Index, and bibliographic records were identified. We also covered the special handling given to data from the DDC Schedules and Relative Index to make this information more presentable, accessible, and understandable to online catalog subject searchers.

Data in bibliographic records were processed into both SOC and DOC. The fields and subfields of the MARC format record selected for inclusion in SOC and DOC were listed, and fields and subfields selected for indexing and/or display were marked accordingly. In SOC, special handling was given to data in the call number field to separate the class number from the call number for class number searches in SOC, and the LC subject field to correct misspelled subject headings and headings bearing typographical errors. In DOC, special handling was given to a number of fields, the most important of which was the creation of a Schedules DDC class number. Once created and added to the bibliographic record, this Schedules DDC class number allowed DOC to automatically match class numbers in libraries' bibliographic records with class numbers in the DDC Schedules and Relative Index to add subject-rich information from the Schedules and Relative Index to the bibliographic record.

At times, it was difficult to focus this discussion solely on the selection of subject information from bibliographic records, DDC Schedules, and the Relative Index without touching upon subject searching in the experimental online catalog. Tables 5 and 6 listed the bibliographic record fields and the SOC and DOC subject searches which accessed the subject-rich data in these fields during online searches. Chapter 5 contains an in-depth description of subject searching in the experimental online catalog.

5. Subject Searching in the Experimental Online Catalog

5.1 Introduction

The functionality and the operation of the experimental online catalog are described in this chapter. The experimental online catalog is actually composed of two online catalogs: (1) the Dewey Online Catalog (DOC), in which the Dewey Decimal Classification has been incorporated as a searcher's tool for subject access, browsing, and display; and (2) the Subject Online Catalog (SOC), in which the DDC has not been incorporated.

When designing and developing the experimental online catalog, we wanted first time users of SOC and DOC to be able to search these catalogs with ease and find items relevant to their expressed topic, since most of the searchers in the library patron and staff retrieval tests would be using the experimental online catalog for the first time. We expected to recruit library patrons for the retrieval tests who had never before used an online catalog, especially at PLCFC, which had no online catalog, and at LC and NYSL, which always have many first-time visitors to the library. Furthermore, searching DOC introduced library patrons to the DDC Schedules and Relative Index for the first time. Thus, the experimental online catalog was a menu-based system, which we felt was an appropriate interface for first-time users. The catalog's capabilities and interface were continually reviewed by the four participating libraries' staff, project consultants, Decimal Classification Division staff, and interested OCLC staff during the design and development process to ensure the catalog's ease of use.

We also wanted the functionality and interface of SOC and DOC to be very similar to reduce bias in the retrieval tests. If SOC and DOC had totally different interfaces, there was a good chance that patrons' satisfaction with a search and their system preference would be affected by differences in the interface.

Similarly, the functionality and operation of SOC and DOC differed because DOC had added two sources of subject information, viz., DDC Schedules and Relative Index, which allowed DOC's functionality to be enriched by this information and its operation to become more complex through the handling of this information. Yet, there was subject information in SOC and DOC that came from different sources, i.e., subject headings and Relative Index entries respectively, that was accessed in much the same way in both systems. Then, there was subject information in DOC, i.e., DDC Schedules, that had no counterpart in SOC and required the introduction of subject searching capabilities unique to DOC.

In sections 5.2 and 5.3, the functionality of SOC and DOC are described and examples from SOC and DOC searches are provided. In general, this discussion is not technical and is an adequate overview of the experimental online catalog's functionality in preparation for reading the results of the retrieval tests in chapters 7 and 8. Technical details of the organization of the experimental online catalog and the operation of SOC and DOC are given in sections 5.4 and 5.5, respectively. System designers and library staff involved in the system design process may find the contents of section 5.5 a valuable foundation when planning to enhance their online catalogs with a library classification. However, in section 9.5 we highlight the drawbacks of our design of the Dewey Online Catalog due to our hardware and time limitations and make recommendations regarding improvements to DOC based on this knowledge and our findings in the online retrieval tests.

5.2 Subject Searching in the Subject Online Catalog (SOC)

SOC has the traditional subject searching capabilities of online catalogs, namely subject heading, subject heading and title keyword, and class number searches. The process of subject searching in SOC is presented in flowchart format in fig. 12. The user matches his terms with (1) indexed subject headings, (2) keywords from subject-rich fields in bibliographic records, or (3) DDC class numbers. The system responds with the number of items retrieved and allows the user to display the retrieved items. The major differences between this process illustrated in fig. 12 and the SOC subject searching process we envisioned at the beginning of the project (see fig. 4) is that refining the results of a search statement using Boolean operations is not offered to SOC searchers (because of the space limitations of the computer hardware used in the DDC Online Project [see section 3.4]).

The process shown in fig. 12 is actually a simplified representation of subject searching in SOC. The process of SOC searching is evident in the option menus for SOC searchers (see fig. 13). Except for Menu 1 in fig. 13, the options listed in the menu boxes appear on the bottom of the screen, informing the user of possible next options. SOC users can only select from the menu of options listed to continue the search. Menu 1 is the first screen encountered by SOC searchers (except for the Review Sets [RS] option).

When a SOC user begins his search, he has a choice of (1) searching alphabetically (SA), obtaining a list of alphabetically arranged subject headings in response to an entered term; (2) searching directly (SD), obtaining a report of the number of items containing his entered access point; or (3) searching for call number, obtaining a report of the number of items bearing the entered call number (fig. 13, Menu 1). Thus, the SOC user has the following options when initiating a search in SOC:

SA	Search alphabetically for subject
SD	Search directly for subject
SC	Search for call number
ES	End search

While figures 12 and 13 present diagrammatic representations of subject searching in SOC, an overview of SOC subject searching in the form of a verbal description is provided in table 8. In appendix D, definitions of SOC options

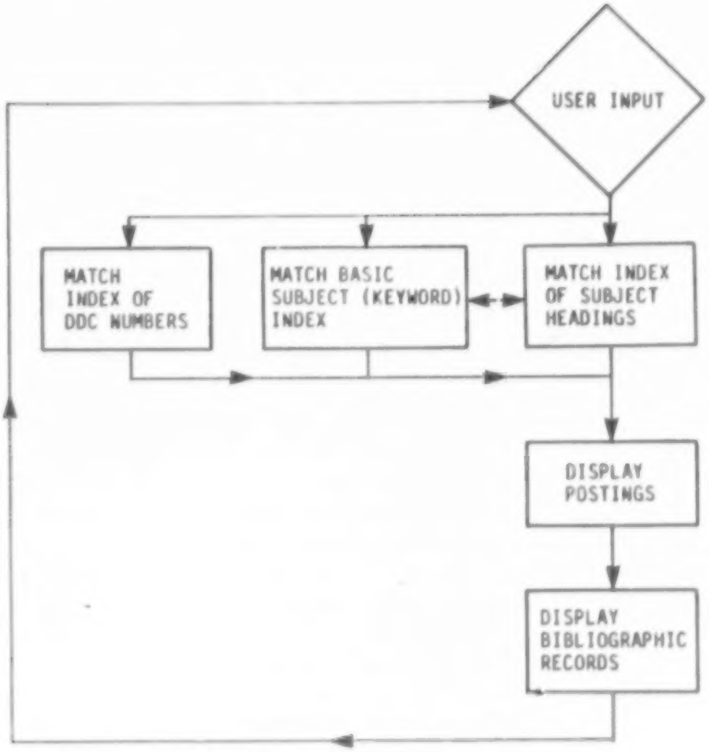

USER INPUT
MATCH INDEX OF DDC NUMBERS
MATCH BASIC SUBJECT (KEYWORD) INDEX
MATCH INDEX OF SUBJECT HEADINGS
DISPLAY POSTINGS
DISPLAY BIBLIOGRAPHIC RECORDS

Fig. 12. Flowchart of the process of subject searching in SOC

are provided. Sections 5.2.1-5.2.3 feature the three types of SOC subject searches and examples, and section 5.2.4 features the display of bibliographic records in SOC.

5.2.1 Alphabetical Subject Searching

In the alphabetical search (SA option), the user enters a term or phrase and the system responds with a list of ten subject headings, called a List of Aspects, from the library's bibliographic records. These subject headings are in the alphabetical neighborhood of the user-entered term. If the user matches an indexed subject heading, the matched subject heading is listed on the third line of the List of Aspects accompanied by the number of items bearing the subject heading. Otherwise, the user-entered term is not displayed, but the best match of this term in the alphabetically arranged List of Aspects is

Menu Screens: Subject Online Catalog

```
Menu 1 |--------------------------------------------------|
       | SA Search alphabetically for subject ===========|==>Menu 2
       | SD Search directly for subject =================|==>Menu 3
       | SC Search for call number ======================|==>Menu 4
       | RS Review sets (1)  ============================|==>Menu 4
       | ES End search                                    |
       |--------------------------------------------------|

Menu 2 |--------------------------------------------------|
       | [ List of Aspects (subject headings) ]           |
       |                                                  |
       | BF Browse forward in alphabetical list           |
       | BB Browse backward in alphabetical list          |
       | SD Search directly for previous subject ========|==>Menu 4
       | SL Select line(s) to display items               |
       | SO Start over ==================================|==>Menu 1
       |--------------------------------------------------|

Menu 3 |--------------------------------------------------|
       | [ List of Sets ]                                 |
       |                                                  |
       | SA Search alphabetically for previous subject ==|==>Menu 5
       | DI Display items (1)                             |
       | SO Start over ==================================|==>Menu 1
       |--------------------------------------------------|

Menu 4 |--------------------------------------------------|
       | [ List of Sets ]                                 |
       |                                                  |
       | DI Display items (1)                             |
       | SO Start over ==================================|==>Menu 1
       |--------------------------------------------------|

Menu 5 |--------------------------------------------------|
       | [ List of Aspects (subject headings) ]           |
       |                                                  |
       | BF Browse forward                                |
       | BB Browse backward                               |
       | SL Select line(s) to display items               |
       | SO Start over ==================================|==>Menu 1
       |--------------------------------------------------|
```

(1) Shown only if there is at least one set

Fig. 13. Options for SOC searchers during the online search process

usually found on the third line of the List of Aspects. For example, a user with the expressed topic of "Personal Loans" who enters the phrase "personal loans" into SOC would obtain the List of Aspects shown in fig. 14.

SOC's List of Aspects has three columns: (1) the line identification letter which the searcher can use to refer to a listed subject heading when selecting an option from the options menu following the List of Aspects (labeled LINE); (2) the number of items bearing the subject heading (labeled ITEMS); and (3) the subject heading itself (labeled TOPICS--ASPECTS). The subjects used in this alphabetical search are subject headings that have been collected from the subject heading fields in the library's bibliographic records (see the Search column of table 5 marked with SA).

To fit all three columns of the List of Aspects within one eighty-character line, the subject headings have been truncated to sixty characters. This means that two different subject headings having the first sixty characters in common are listed in one subject heading on the list. Although this can be slightly misleading, it is acceptable because few subject headings were longer than sixty characters. Although only the first sixty characters of a subject heading are displayed in the List of Aspects, the entire subject heading is maintained in the bibliographic record, which can be viewed when the user selects the SL (select line to display items) option.

Table 8. SOC Subject Searching Capabilities

SOC Option Code	Functional Description	Source of Subject Terms for Indexing	Wisest Subsequent User Action(s)
SA	Search for subject and browse an alphabetical list of subjects near your subject	Assigned subject headings from the library's bibliographic records	Browse backward or forward (BB or BF option) or select a listed subject heading to display retrieved items (SL option)
SD	Search directly for subject and retrieve number of items on your subject	Keyword, implicit Boolean AND search of title, subject heading, series, and notes words in bibliographic records	Display retrieved items (DI option)
SC	Search directly for call number and retrieve number of items with your call number	Class numbers created from class number subfield of the library's bibliographic records	Display retrieved items (DI option)

The SOC user can browse backward or forward in this list of subject headings to obtain a list of ten more subject headings that come alphabetically before or after the List of Aspects currently displayed. Two contiguous lists always have one subject heading in common to provide continuity between lists. In fact, the user can browse the entire list of subject headings from A to Z by repeatedly selecting options to browse forward (BF) or backward (BB). The user could select option SD to search directly for the terms just entered using the SA option (fig. 13, Menu 2).

When the user selects one or more listed subject headings, SOC saves the retrieved items in a set. For example, a user selecting line D in a search obtains the response from SOC shown in fig. 14.

```
>>>>> YOUR REQUEST...sl d
      1 ITEM IN SET 1 (Personality and occupation)


What would you like to do? > sa
Enter subject to search > personal loans

>>>>> YOUR REQUEST...sa:personal loans

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
  IF YOUR SUBJECT IS NOT LISTED, TRY ANOTHER SEARCH OPTION.
LINE ITEMS TOPICS--ASPECTS
   A     1 Perpetuities--New Zealand
   B     1 Persian Gulf region--Foreign economic relations--Japan
   C     2 Personality
   D     1 Personality and occupation
   E     1 Personnel departments
   F     1 Personnel departments--United States--Statistics
   G    44 Personnel management
   H     5 Personnel management--Addresses, essays, lectures
   I     2 Personnel management--Case studies
   J     1 Personnel management--Communist countries

OPTION  DESCRIPTION
    BF  Browse forward in this alphabetical list
    BB  Browse backward in this alphabetical list
    SD  Search directly for "personal loans"
    SL  Select line(s) to display items
    SO  Start over
```

Fig. 14. List of alphabetically arranged subject headings in a SOC alphabetical search for "personal loans" (List of Aspects)

The alphabetical search allows SOC users to browse an alphabetically arranged index of the subject headings contained in the library's bibliographic records. Unfortunately, the List of Aspects only provides users access to the leftmost term in subject headings. The alphabetical search does not provide users access to the innards of subject headings. That is why we added the SD (search directly for subject) search to the options menu following the List of Aspects to prompt users to continue searching with the same term using a different search option. A SOC user who selects option SD does not need to reenter his search terms; rather, SOC has retained these terms and automatically performs a keyword search of bibliographic records' title, subject, selected note, sponsor, and series fields for these terms.

5.2.2 Direct (Keyword) Searching

The SD (search directly for subject) option in SOC is a keyword and implicit Boolean search (using the AND operator) in which SOC looks for bibliographic records containing the user-entered term in these records' title, subject, selected note, sponsor, and series fields. In fig. 15, SOC is shown performing a direct search for "personal loans." This option was chosen immediately following the alphabetical search shown in fig. 14 for the same topic. Thus, the user does not have to reenter his search terms "personal loans" because SOC has retained these terms and automatically enters them into the system and displays the result. SOC saves the results in set 2 and also displays the saved set for a subject heading selected in the previous interaction.

```
What would you like to do? > sd

>>>>> YOUR REQUEST...sd:personal loans
          139 ITEMS FOR "personal"
          111 ITEMS FOR "loans"
            3 ITEMS IN SET 2 (personal loans)

THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
SET  ITEMS    REQUEST
  1      1    sa:Personality and occupation
  2      3    sd:personal loans

OPTION  DESCRIPTION
    DI  Display items
    SO  Start over
```

Fig. 15. Number of retrieved items and options in a SOC direct search for "personal loans"

Although the result of a direct search is a set of records whose indexed fields contain all the words in the user-entered term, SOC does not perform the search by checking for the presence of all given words in each record. Instead, it looks for a set of records containing the first word, a set containing the second word, a set containing the last word, and finally finds the records common to these three intermediate sets. This process is reflected by the intermediate results being displayed, such as "139 ITEMS FOR 'personal'" and "111 ITEMS FOR 'loans'", "3 items in set 2 (Personal loans)" in the above example. Due to this searching method, the order of terms in the entered term is not important. In contrast, the order of terms in the user-entered term was very important in the alphabetical search (see 5.2.1).

Not all words in the user-entered term are selected by SOC to check in its index for the direct search. Conversely, not all words in the fields of bibliographic records are indexed in SOC's index for the direct search. In both, a selected list of words (called stopwords) and one-letter words are not selected by SOC for searching or indexing (see appendix E). Stopwords are usually prepositions, articles, and conjunctions, e.g., from, to, of, a, and, the. Because stopwords are neither searched nor indexed, a direct search for "stocks or bonds," "stocks bonds," "bonds stocks," or "bonds and stocks" yields the same results. For readers familiar with DIALOG or BRS searching, SOC treats any one of these four examples as DIALOG would treat the search statement "SS STOCKS AND BONDS" or as BRS would treat the search statement (in search mode) "STOCKS AND BONDS."

The only options provided to the user after the direct search are (1) the capability to display retrieved items (using the DI, display items, option) if items have been retrieved or (2) the option to start over (SO). (See fig. 13, Menu 4.) A user initiating a search using the direct search (SD) option would have been provided the option to search alphabetically (fig. 13, Menu 3).

The alphabetical search (SA option) and direct search (SD option) work together to help the user find items bearing his entered terms. In an alphabetical search, the user is prompted to perform a direct search and vice versa. If we do not prompt the user, we feel that most users would merely start over and enter their expressed topic using different terms. In fact, such a system design (i.e., without prompting) would penalize users whose entered terms match keywords in the system and not subject headings as in the examples of figures 14 and 15, or whose entered terms almost match (disregarding punctuation or minor spelling differences) a subject heading and not keywords in the system.

5.2.3 Call Number Searching

We named this subject search "Search for call number" (SC option) because we felt that most online catalog users would not know what "class number" meant. In fact, this search is really a class number search. (Only class number searching for DDC class numbers is featured in SOC and DOC; class number searching for LC classification numbers is not offered in SOC or DCC.)

The user enters a DDC class number of three or more digits, which SOC compares with the library DDC class numbers of bibliographic records (see the Search column of table 5 marked SC). SOC treats the class number as if it had been truncated, and thus retrieves records with the exact class number entered and class numbers beginning with the entered number. For example, the user inputting the class number 332.743 retrieves records assigned class numbers 332.743 and 332.7430202.

In fig. 16, the interaction between SOC and a user entering a class number is shown. In this example, SOC responds with number of items retrieved bearing the user-entered class number or beginning with this class number, saves the results in set 3 and gives the user the option to display items (DI) or start over (SO) (fig. 13, Menu 4). Note that the library DDC class number is used for this search, but the DDC call number is displayed in retrieved bibliographic records (see table 5).

```
What would you like to do? > sc
Enter call number > 332.743

>>>>> YOUR REQUEST...sc:332.743
       10 ITEMS IN SET 4  (332.743)

    THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
    SET  ITEMS    REQUEST
      1      1    sa: personality and occupation
      2      3    sd: personal loans
      3     10    sc:332.743

OPTION   DESCRIPTION
    DI   Display items
    SO   Start over
```

Fig. 16. Number of retrieved items and options in a SOC call number search for "332.743"

5.2.4 Bibliographic Record Display

A set of bibliographic records in SOC can be created in one of three ways: (1) the selection of subject(s) during the browsing of the List of Aspects in the alphabetical search; (2) direct search; or (3) call number search. Once a set has been created, the user can display it again later in the same session without having to repeat the search. A Summary of Searches can be requested for review using the review searches (RS) option (fig. 17).

```
What would you like to do? > rs

>>>>> YOUR REQUEST...rs

    THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
    SET  ITEMS    REQUEST
      1      1    sa:Personality and occupation
      2      3    sd:personal loans
      3     10    sc:332.743

OPTION   DESCRIPTION
    DI   Display items
    SO   Start over
```

Fig. 17. Summary of searches in SOC

The summary of searches given in fig. 17 shows the set numbers, the number of items in the sets, and the searches from which the sets were created. The sets in a session are numbered sequentially, starting with 1. The highest possible set number in a session is 10. When the 11th set is about to be created, the user is told by SOC that the seven oldest sets (i.e., sets 1-7) are being erased, the three newest (i.e., sets 8-10) are being renumbered from 1 to 3, and the set being created is numbered 4.

Only one set can be displayed at a time. After displaying all the items in a set, SOC returns to the Summary of Searches. During the bibliographic record display, SOC stops at the end of each record so that the user has the chance to scan the record before asking for the next one or stopping the display altogether. SOC displays the records in increasing order of the library DDC class number, i.e., in shelflist order. Each displayed record is preceded by "i OF n" where "i" is the record number in the set and "n" is the total number of records (see fig. 18).

The format of a bibliographic record display is shown in fig. 18. The full format of the record is the one and only format available. All the fields that are to be displayed are labeled in the Display in Bibliographic Records column of table 5.

Note that, for Library of Congress, the LC call number is labeled "LC CALL NUMBER" and DDC call number is labeled "DEWEY NUMBER." For the other three libraries, the DDC call number is labeled "CALL NUMBER." (These three libraries' records do not contain LC call numbers.) The COLLECTION field is labeled and listed in NYSL bibliographic records only.

```
i OF n

LC CALL NUMBER          ............................ (for LC)
CALL NUMBER             ............................ (for UI, NYSL, PLCFC)
COLLECTION              ............................ (for NYSL)
TITLE                   ............................
ALTERNATE TITLE         ............................
LC SUBJECT              ............................
CONTENTS                ............................
DEWEY NUMBER            ............................ (for LC)
AUTHOR                  ............................
SPONSOR                 ............................
EDITION                 ............................
PUBLISHER               ............................
SERIES                  ............................
```

Fig. 18. Bibliographic record display in SOC

5.3 Subject Searching in the Dewey Online Catalog (DOC)

DOC has both the traditional subject searching capabilities of SOC and enhanced subject searching capabilities because the DDC Relative Index and DDC Schedules and notes have been integrated into DOC's subject searching capabilities. The process of subject searching in DOC is presented in flowchart format in fig. 19. The user matches his terms with (1) indexed Relative Index entries, (2) keywords from subject-rich fields in bibliographic records, DDC Schedules, and Relative Index, (3) keywords from bibliographic records' first-listed subject heading, DDC Schedule captions and notes, and Relative Index entries, or (4) DDC class numbers. In 1 and 2 above, the system responds much like SOC, i.e., it gives the number of items retrieved and allows the user to display retrieved items. In 3 and 4 above, the system directs the user to one or more class number areas where there are bibliographic records containing the user-entered term or user-entered class number. DOC is able to respond to the user in such a way because its subject searching capabilities have been enhanced with the DDC Schedules and Relative Index. The major difference between the process in fig. 19 and the DOC subject searching process we envisioned at the beginning of the project (see fig. 4) is that refining the results of a search statement using Boolean operations is not offered to DOC searchers because of the space limitations in the computer hardware used in the DDC Online Project (see section 3.4).

The process shown in fig. 19 is actually a simplified representation of subject searching in DOC. The process of DOC searching is evident in the option menus for searchers in fig. 20. Except for Menu 11 in fig. 20, the options listed in the menu boxes appear on the bottom of the screen to inform the user of possible next options. DOC users can only select from the option menu listed to further the action of the search. Except for the Review Sets (RS) option, Menu 11 in fig. 20 is the initial screen encountered by DOC searchers.

When a DOC user begins searching, he has a choice of (1) searching alphabetically (SA), obtaining a list of alphabetically arranged Relative Index entries in response to an entered term; (2) searching subject outlines of the DDC Schedules (SS), obtaining a report of the classification areas where there are records containing the user-entered terms; (3) searching directly (SD), obtaining a report of the number of items retrieved by the user-entered term through a keyword and implicit Boolean search; and (4) searching for call number (SC), obtaining a report of number of items and subject outline of the DDC Schedules for the best match of the user-entered call number in the DDC Schedules. Thus, the DOC user has the following options when initiating a search in DOC:

SA	Search alphabetically for subject
SS	Search subject outline for subject
SD	Search directly for subject
SC	Search for call number
ES	End search

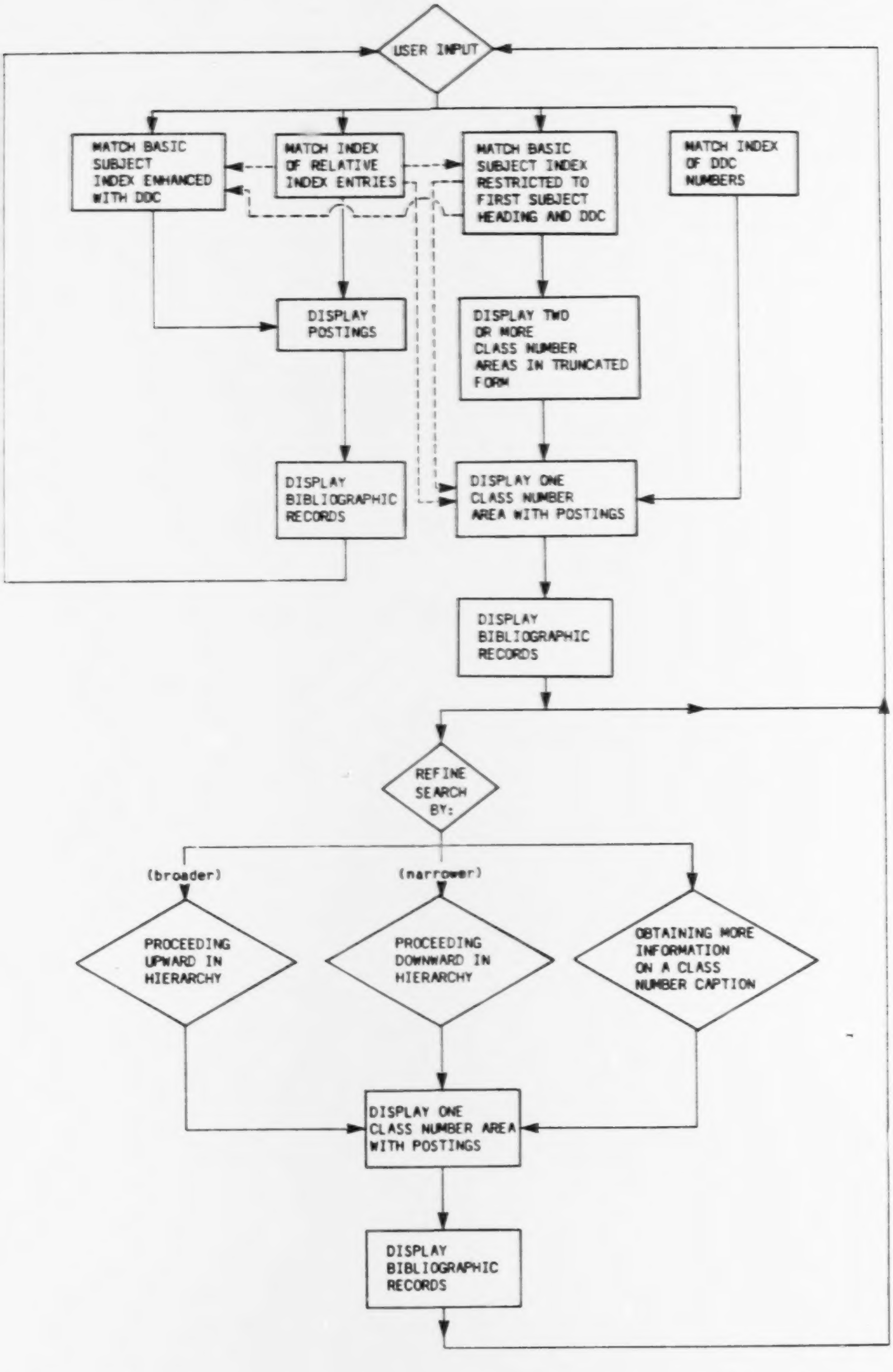

USER INPUT
MATCH BASIC SUBJECT INDEX ENHANCED WITH DDC
MATCH INDEX OF RELATIVE INDEX ENTRIES
MATCH BASIC SUBJECT INDEX RESTRICTED TO FIRST SUBJECT HEADING AND DDC
MATCH INDEX OF DDC NUMBERS
DISPLAY POSTINGS
DISPLAY TWO OR MORE CLASS NUMBER AREAS IN TRUNCATED FORM
DISPLAY BIBLIOGRAPHIC RECORDS
DISPLAY ONE CLASS NUMBER AREA WITH POSTINGS
DISPLAY BIBLIOGRAPHIC RECORDS
REFINE SEARCH BY:
(broader)
(narrower)
PROCEEDING UPWARD IN HIERARCHY
PROCEEDING DOWNWARD IN HIERARCHY
OBTAINING MORE INFORMATION ON A CLASS NUMBER CAPTION
DISPLAY ONE CLASS NUMBER AREA WITH POSTINGS
DISPLAY BIBLIOGRAPHIC RECORDS

Fig. 19. Flowchart of the process of subject searching in DOC

Menu Screens: Dewey Online Catalog

```
Menu 11  ---------------------------------------------------
        | SA Search alphabetically for subject =============|==>Menu 12
        | SS Search subject outline for subject (2) ========|==>Menu 13
        | SD Search directly for subject ===================|==>Menu 16
        | SC Search for call number ========================|==>Menu 15
        | RS Review sets (1) ===============================|==>Menu 16
        | ES End search                                     |
         ---------------------------------------------------
Menu 12  ---------------------------------------------------
        | [ List of Aspects (Relative Index entries) ]      |
        | BF Browse forward in alphabetical list            |
        | BB Browse backward in alphabetical list           |
        | ST Search subject outline for topic from list ====|==>Menu 14
        | SS Search subject outline for previous subject (2)|==>Menu 13
        | SD Search directly for previous subject ==========|==>Menu 16
        | SL Select line(s) to display items                |
        | SO Start over ====================================|==>Menu 11
         ---------------------------------------------------
Menu 13 ----------------------------------------------------
        | [ List of Perspectives ]                          |
        | BP Browse a perspective ==========================|==>Menu 14
        | SO Start over ====================================|==>Menu 11
         ---------------------------------------------------
Menu 14  ---------------------------------------------------
        | [ List of Topics (DDC Schedule captions) ]        |
        | BG Browse more general topics                     |
        | BS Browse more specific topics                    |
        | GN Get detailed notes for a topic                 |
        | SL Select line(s) to display items                |
        | RP Return to perspectives list ===================|==>Menu 13
        | SO Start over ====================================|==>Menu 11
         ---------------------------------------------------
Menu 15  ---------------------------------------------------
        | [ List of Topics (DDC Schedule captions) ]        |
        | BG Browse more general topics                     |
        | BS Browse more specific topics                    |
        | GN Get detailed notes for a topic                 |
        | SL Select line(s) to display items                |
        | SO Start over ====================================|==>Menu 11
         ---------------------------------------------------
Menu 16  ---------------------------------------------------
        | [ List of Sets ]                                  |
        | DI Display items (1)                              |
        | SO Start over ====================================|==>Menu 11
         ---------------------------------------------------

(1) Shown only if there is at least one set
(2) Menu 14 if there is only one perspective
```

Fig. 20. Options for DOC searchers during the online search process

While figures 19 and 20 present diagrammatic representations of subject searching in DOC, an overview of DOC subject searching in the form of a verbal description is provided in table 9. In appendix F, definitions of DOC options are provided. Sections 5.3.1-5.3.4 feature the four types of DOC subject searches and examples, and section 5.3.5 features the display of bibliographic records in DOC.

5.3.1 Alphabetical Subject Searching

In the alphabetical search (SA option), the user enters a term or phrase and the system responds with a list of ten entries from the DDC Relative Index called a List of Aspects. These Relative Index entries are in the alphabetical neighborhood of the user-entered term. If the user matches an indexed Relative Index entry, the matched entry is listed on the third line of the List of Aspects accompanied by a number of items. This number of items refers to the bibliographic records in the database bearing the class number associated with the Relative Index entry in the printed DDC Relative Index. While this class number is listed alongside entries in the printed Relative Index, it is not included in DOC's display of Relative Index entries for the reason explained in section 3.4. If the user-entered term does not match an indexed Relative Index entry, DOC does not include the user-entered term among the listed ten entries, but usually lists the best match of this term in the alphabetically arranged List of Aspects on the third line and lists nine other entries in the alphabetical neighborhood of the user-entered term on the remaining lines. For example, a user with the expressed topic of "Personal Loans" who enters the phrase "personal loans" into DOC would obtain the List of Aspects shown in fig. 21.

Table 9. DOC Subject Searching Capabilities

DOC Option Code	Functional Description	Source of Subject Terms for Indexing	Wisest Subsequent User Action(s)
SA	Search for subject and browse an alphabetical list of subjects near your subject	DDC Relative Index entries matching class numbers in the library's bibliographic records	Browse forward or backward in the alphabetical list (BF or BB option), or select a listed Relative Index entry to obtain a subject outline from the classification Schedules (ST option), or select a listed Relative Index entry to display retrieved items (SL option)

Table 9. DOC Subject Searching Capabilities (continued)

DOC Option Code	Functional Description	Source of Subject Terms for Indexing	Wisest Subsequent User Action(s)
SS	Search for subject and browse an outline of subjects related to your subject	Keyword, implicit Boolean AND search of DDC Relative Index entries, DDC Schedules and notes, and the first subject heading listed in the library's bibliographic records directing users to outlines of DDC Schedule captions in the classification area(s) where there are records bearing the user-entered term	Browse more specific DDC Schedule captions (BS option), or select a listed DDC Schedule caption to display retrieved items (SL option)
SD	Search directly for subject and retrieve number of items on your subject	Keyword, implicit Boolean AND search of title, subject heading, series, note, DDC Relative Index entry, and DDC Schedule and note words in bibliographic records	Display retrieved items (DI option)
SC	Search for call number and browse an outline of meanings of call numbers	Class numbers created from the class number field of DDC Schedule records directing users to outlines of DDC Schedule captions in the classification area matching user-entered call number	Browse more specific DDC captions (BS option), or select a listed DDC Schedule caption to display retrieved items (SL option)

DOC's List of Aspects has three columns: (1) the line identification number that the searcher can use to refer to a listed entry when selecting an option from the options menu following the List of Aspects (labeled LINE); (2) the number of items bearing the class number associated with the entry (and included in the printed DDC Relative Index (labeled ITEMS); and (3) the Relative Index entry itself (labeled TOPICS--ASPECTS).

```
What would you like to do? > sa
Enter subject to search > personal loans

>>>>> YOUR REQUEST...sa:personal loans

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
  IF YOUR SUBJECT IS NOT LISTED, TRY ANOTHER SEARCH OPTION.
LINE  ITEMS  TOPICS--ASPECTS
   A      2  Performance--evaluation--executive management
   B     32  Performance--surveys--personnel administration--general management
   C     21  Personal--distribution--national income
   D     59  Personal--finance--economics
   E      7  Personal--income taxes--public finance
   F      1  Personal--income--macroeconomics
   G      1  Personal--income--tax reductions--public finance
   H     10  Personal--loans--economics
   I      5  Personal--qualifications--employees--selection--general management
   J     33  Personal--selling--marketing management

OPTION   DESCRIPTION
    BF   Browse forward in this alphabetical list
    BB   Browse backward in this alphabetical list
    ST   Search subject outline for a topic from the list
    SS   Search subject outline for "personal loans"
    SD   Search directly for "personal loans"
    SL   Select line(s) to display items
    SO   Start over
```

Fig. 21. List of alphabetically arranged Relative Index entries in a DOC alphabetical search for "personal loans" (List of Aspects)

The Relative Index entries used in this alphabetical search are Relative Index entries which have been added to each library's bibliographic records (see section 4.3.3) and collected from the Relative Index entry fields in these bibliographic records (see the Search column of table 6 marked "SA").

To fit all three columns of the List of Aspects within one eighty-character line, entries have been truncated to sixty characters. This means that two different Relative Index entries having the first sixty characters in common are listed in one entry on the list. This can be slightly misleading but acceptable because the unique portion of most Relative Index entries was the initial word or phrase; thus, most unique Relative Index entries were listed separately in DOC's List of Aspects. Entries are not displayed in the bibliographic records for the reason given in section 4.4.3.6.

Relative Index entries were automatically entered into DOC with little editing except replacement of abbreviations. When secondary Relative Index entries were concatenated to the main Relative Index entry, the indentions in the printed Relative Index entry were replaced with two hyphens. The result of this automatic concatenation was a string of terms which could have been expressed as a phrase separated by hyphens. In fig. 21, the Relative Index entry on line H, "Personal--loans--economics," best expresses the user-entered term "personal loans." In this Relative Index entry, the first two terms on line H would make more sense to a searcher without the hyphens and would have been a closer match to the user-entered term. We did not manually edit any Relative Index entries because of the amount of time required for such a process. We expect that few users would enter their terms into DOC separated by hyphens; thus, there will probably be few users matching index Relative Index entries exactly in the retrieval tests (see section 8.5.2).

The DOC user can browse forward or backward in this list of Relative Index entries to obtain a list of ten more entries alphabetically before or after the List of Aspects currently displayed (fig. 20, Menu 12). Two contiguous lists always have one entry in common to provide continuity between lists. In fact, the user can browse the entire list of Relative Index entries from A to Z by repeatedly selecting options to browse forward (BF) or browse backward (BB). The user could select option SS (search subject outline for subject) or select option SD (search directly for subject) to perform a different subject search on the user-entered term without having to reenter this term. (See sections 5.3.2 and 5.3.4 for explanations of the SS and SD search options.)

The alphabetical search allows DOC users to browse an alphabetically arranged index of Relative Index entries. Unfortunately, the List of Aspects only provides users access to the leftmost term in Relative Index entries. The alphabetical search does not provide users access to the innards of these entries. That is why we added the SS (search subject outline for subject) and SD (search directly for subject) searches to the options menu following the List of Aspects to prompt users to continue searching with the same term using a different search option.

In alphabetical searches, the DOC user also has the option to browse the DDC Schedules by selecting a listed Relative Index entry using the ST (search subject outline for a listed topic). This searching procedure is analogous to the classifier's procedure of looking for a subject in the printed *DDC Relative Index*, noting the DDC number associated with this subject, and locating this DDC number in the printed *DDC Schedules*. Choosing a line identification letter from the List of Aspects (i.e., the DDC Relative Index), the user sees a List of Topics (i.e., the DDC Schedules) to which the chosen entry points. For example, if the user chooses line H from the List of Aspects in fig. 21, DOC displays the List of Topics shown in fig. 22, which is the DDC class number and captions where the selected Relative Index entry points. This List of Topics is described in greater detail in section 5.3.3; once the List of Topics is displayed, the search procedure is identical to DOC's call number search (see section 5.3.3).

```
What would you like to do? > st
Enter a line to search > h

>>>>> YOUR REQUEST...st h

ITEMS ON YOUR SUBJECT ARE FOUND UNDER 332.743 IN THIS OUTLINE OF RELATED
SUBJECTS.

GENERAL TOPIC : 332.74 Other forms of credit
    LINE  ITEMS  AREA             TOPIC
       A      3  332.742          Commercial, mercantile, industrial
*      B     10  332.743          Personal loans

OPTION   DESCRIPTION
    BG   Browse more general topics
    BS   Browse more specific topics
    GN   Get detailed notes for a topic
    SL   Select line(s) to display items
    SO   Start over
```

Fig. 22. List of Topics from the DDC Schedules resulting from selection of a Relative Index entry in the alphabetical search

When the user selects one or more entries from the List of Aspects, DOC saves the retrieved items in a set. For example, the user selecting line H in the search in fig. 21 obtains the following response from DOC:

```
>>>>> YOUR REQUEST...sl h
       10 ITEMS IN SET 1  (Personal--loans--economics)
```

This selected Relative Index entry (on line H) is the best match of the user-entered term "personal loans." It was listed on line H of the List of Aspects instead of line C (i.e., the third line of the List of Aspects) because DOC sorts spaces before hyphens. Thus, DOC's best match of the user-entered term is listed on line C of fig. 21. Had DOC ignored the special characters (i.e., hyphens) in the Relative Index entries when matching entries with the user-entered term, the most appropriate entry, i.e., "Personal--loans-- economics," would have been listed on the third line (line C) of the List of Aspects instead of on line H.

5.3.2 Direct (Keyword) Searching

The definition of the direct search in DOC (SD option) is the same as that in SOC (i.e., a keyword and implicit Boolean search using the AND operator) with an important difference: DOC performs a keyword search for the user-entered term in the same fields searched by SOC (i.e., title, subject, selected note, sponsor, and series fields) plus fields added to DOC records from the DDC Schedules and Relative Index--DDC Schedule caption, DDC Schedule notes, and DDC Relative Index entry (see the Search column of table 6 marked SD).

Figure 23 displays the results of a DOC direct search for "personal loans." DOC saves the results in set 2 and also displays the saved set for a Relative Index entry selected in the previous interaction.

Although the result of a direct search is a set of records whose indexed fields contain all the words in the user-entered term, DOC does not perform the search by checking for the presence of all given words in each record. Instead, it looks for a set of records containing the first word, a set containing the second word, then a set for each subsequent word, and finally finds the records common to these three intermediate sets. As a part of this process, the intermediate results are displayed (e.g., "397 ITEMS FOR 'personal'" and "159 ITEMS FOR 'loans'" in fig. 23). Due to this searching method, the order of terms in the user-entered term is not important. In contrast, the order of terms in the user-entered term was very important in the alphabetical search (see section 5.3.1).

DOC does not select all words in the user-entered term when checking its index for the direct search. Conversely, not all words in the fields of bibliographic records are indexed in DOC's index for the direct search.

```
What would you like to do? > sd
Enter subject to search > personal loans

>>>>> YOUR REQUEST...sd:personal loans
      397 ITEMS FOR "personal"
      159 ITEMS FOR "loans"
       12 ITEMS IN SET 2  (personal loans)

    THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
    SET  ITEMS    REQUEST
      1     10    sa:Personal--loans--economics
      2     12    sd:personal loans

OPTION   DESCRIPTION
    DI   Display items
    SO   Start over
```

Fig. 23. Number of retrieved items and options in a DOC direct search for "personal loans"

```
What would you like to do? > sc
Enter call number > 332.743

>>>>> YOUR REQUEST...sc:332.743

ITEMS ON YOUR SUBJECT ARE FOUND UNDER 332.743 IN THIS OUTLINE OF RELATED
SUBJECTS.

GENERAL TOPIC : 332.74 Other forms of credit
    LINE  ITEMS  AREA              TOPIC
       A      3  332.742           Commercial, mercantile, industrial
*      B     10  332.743           Personal loans

OPTION   DESCRIPTION
    BG   Browse more general topics
    BS   Browse more specific topics
    GN   Get detailed notes for a topic
    SL   Select line(s) to display items
    SO   Start over
```

Fig. 24. List of Topics from the DDC Schedules in a DOC call number search for "332.743"

In both, a selected list of words called stopwords and one-letter words are not selected by DOC for searching or indexing (see appendix E). Stopwords are usually prepositions, articles, and conjunctions, e.g., from, to, of, a, and, the. Because stopwords are neither searched nor indexed, a direct search for "stocks or bonds," "stocks bonds," "bonds stocks," or "bonds and stocks" yields the same results. For readers familiar with DIALOG or BRS searching, DOC treats any one of these four examples as DIALOG would treat the search statement "SS STOCKS AND BONDS" or as BRS would treat the search statement (in search mode) "STOCKS AND BONDS."

5.3.3 Call Number Searching

We named this subject search "Search for call number" because we felt that most online catalog users would not know what "class number" meant. In fact, this search is really a class number search.

DOC allows users to enter Dewey Decimal Classification numbers with the option SC, i.e., search for call number. SOC merely reports the number of books assigned the exact class number and the number of books assigned class numbers beginning with the user-entered number. DOC's call number search is analogous to consulting a class number in the printed DDC Schedules. DOC responds to the user-entered call number with: (1) a list of topics (or headings) from the DDC Schedules at the same level in the hierarchy as the entered class number; (2) a list of options that allows the user to browse more general or specific headings, to get more information about a listed heading, or to display bibliographic records assigned the heading (fig. 20, Menu 15); and (3) the user-entered class number marked with an asterisk (*) in the left margin. For example, a user entering class number 332.743 would obtain a List of Topics composed of headings from the DDC Schedules from 332.740 to 332.749 (fig. 24).

In the DOC call number search, the user enters a DDC class number of three or more digits. DOC compares the user-entered class number with the Schedules DDC class number (see Search column of table 6 marked "SC," which DOC produces from the library-assigned class number in a library's bibliographic records and class numbers listed in Inforonics-produced DDC Schedule records (see section 4.4.3.2).

In response to a user-entered class number, DOC displays a List of Topics (fig. 24). This list has four columns: (1) the line identification letter (labeled LINE), which the searcher can use to refer to a listed Schedule caption when selecting an option from the options list following the List of Topics (fig. 20, Menu 15); (2) the number of items (labeled ITEMS) assigned the exact class number or beginning with the class number listed under the LOCATION or AREA label; (3) DDC class numbers starting with the same digits and ending in different digits ranging from 0 to 9 labeled LOCATION at NYSL, PLCFC, and UI, and labeled AREA at LC; and (4) the DDC caption or heading associated with the class number. The title of the List of Topics is the class number and caption taken from the more general topic in the DDC hierarchy and labeled GENERAL TOPIC.

To fit one entire level on the screen, each DDC caption has been truncated so that it does not occupy more than one line, and the notes from the DDC Schedules have been excluded from the display. However, the complete DDC caption, Schedule notes and DDC Relative Index entries referring searchers to the listed class number can be viewed by selecting the GN (get detailed notes for a topic) option listed in the options menu following the List of Topics (fig. 20, Menu 15). DOC's display of the class number, caption, and notes from the Schedules and Relative Index entries is shown in fig. 25.

```
What would you like to do? > gn b

>>>>> YOUR REQUEST...gn b

* Notes for items on this TOPIC are found at the designated shelf LOCATION.
  DEWEY INDEX describes the contents of most items found at this shelf
  AREA.

DETAILED NOTES FOR TOPIC : Personal loans

AREA           332.743
TOPIC          Personal loans
INCLUDING      Including chattel mortgages, consumer credit
DEWEY INDEX    Consumer--credit--economics
               Pawnbroking--economics
               Personal--loans--economics
               Secured transactions--credit economics
```

Fig. 25. DOC display of Schedules DDC class number, caption, and notes, and Relative Index entries

When the List of Topics is displayed (fig. 24), the user has four options (fig. 20, Menu 15). The first two options are to browse more general or specific topics. Selecting one of these two options, the user views another List of Topics one level up the DDC hierarchy (i.e., with one digit subtracted from the class number) or one level down the DDC hierarchy (i.e., with one digit added to the class number). The most general level in DOC contains three-digit DDC numbers and the most specific level is where the defined DDC hierarchy ends according to the printed DDC Schedules. The third option is shown in fig. 25 in which the searcher chooses a listed topic to view additional information from the DDC Schedules and Relative Index. The fourth option lets the searcher select a listed caption to display items whose class number matches or begins with the listed class number. A user selecting line B in fig. 24, which best represents the user's topic of interest, would obtain the following DOC response in which DOC saves the search results in set 3:

```
What would you like to do? > sl b

>>>>> YOUR REQUEST...sl b
10 ITEMS IN SET 3  (332.743 Personal loans)
```

Accompanying this message is the first of ten items retrieved. The user can display the next item or return to the List of Topics after each retrieved item is displayed.

5.3.4 Subject Outline Searching

DOC's subject outline search (SS option) is similar to DOC's call number search because it directs searchers to the DDC Schedules (or List of Topics). The two major differences are (1) the class number search is triggered by a user-entered class number and the subject outline search is triggered by a user-entered term; and (2) the class number search always directs the user to one class number area and the subject outline search directs the user to one or more class number areas.

When the searcher enters a term, DOC performs a keyword and implicit Boolean search (using the AND operator) and matches the user-entered term with words in DDC Schedule captions and notes, DDC Relative Index entries, and the first subject heading listed in bibliographic records. The first subject heading is included because this heading is normally the one that represents most precisely the content of the book and should correspond most closely to the class number. In fact, the Library of Congress instructs subject catalogers to "assign subject headings in the order of descending importance, i.e., according to the importance of each subject heading for the assignment of the class number" (Subject Cataloging Division 1984, H80).

In fig. 26, a searcher has entered a subject outline search for "personal loans." In this case, DOC directs the user to one class number area and, specifically, the class number 332.743. The subject outline search accepts a user-entered term and performs a keyword and implicit Boolean search (using the AND operator) to match the user-entered term with words in the DDC Schedule captions and notes, words in DDC Relative Index entries, and words in the first subject heading of the library's bibliographic records to find class numbers common to the matched words. In an operation transparent to the searcher, DOC groups the class numbers beginning with the same three digits. If, at the end of this grouping process, there is only one group of class numbers starting with and sharing the same three-digit DDC class number, DOC directs the user to a List of Topics based on the most general (or shortest) class number in the group. In fig. 26, the user-entered term "personal loans" directed the user to one class number area, and the class number 332.743 was the most general class number that DOC found after grouping the class numbers associated with words in the DDC Schedule caption, notes, DDC Relative Index entries, and words in the first subject heading listed in bibliographic records.

```
What would you like to do? > ss
Enter subject to search > personal loans

>>>>> YOUR REQUEST...ss:personal loans

  Please wait ...

ITEMS ON YOUR SUBJECT ARE FOUND UNDER 332.743 IN THIS OUTLINE OF RELATED
SUBJECTS.

GENERAL TOPIC : 332.74 Other forms of credit
    LINE  ITEMS  AREA              TOPIC
       A      3  332.742           Commercial, mercantile, industrial
*      B     10  332.743           Personal loans

OPTION   DESCRIPTION
    BG   Browse more general topics
    BS   Browse more specific topics
    GN   Get detailed notes for a topic
    SL   Select line(s) to display items
    SO   Start over
```

Fig. 26. List of Topics from the DDC Schedules in a DOC subject outline search for "personal loans"

The List of Topics in a subject outline search contains the same information as the List of Topics in a DOC class number search. This list has four columns: (1) the line identification letter (labeled LINE), which the searcher can use to refer to a listed Schedule caption when selecting an option from the options list following the List of Topics (fig. 20, Menu 14); (2) the number of items (labeled ITEMS) assigned the exact class number or beginning with the class number listed under the LOCATION (or AREA) label; (3) DDC class numbers starting with the same digits and ending in different digits ranging from 0 to 9 (labeled LOCATION at NYSL, PLCFC, and UI, and labeled AREA at LC); and (4) the DDC caption or heading associated with the class number (labeled TOPIC). The title of the List of Topics is the class number and caption taken from the more general topic in the DDC hierarchy and labeled GENERAL TOPIC.

To fit one entire level on the screen, each DDC caption has been truncated so that it does not occupy more than one line, and the notes from the DDC Schedules have been excluded from the display. However, the complete DDC caption, Schedule notes, and DDC Relative Index entries referring searchers to the listed class number can be viewed by selecting the GN (get detailed notes for a topic) option listed in the options menu following the List of Topics (fig. 20, Menu 14). DOC'S display of the class number, caption, and notes from the Schedules and Relative Index entries is shown in fig. 25.

Let's take an example in which the user-entered term directs the searcher to more than one class number area. In fig. 27, the searcher entered the term "loans." DOC matched the user-entered term with words in the DDC Schedule captions and notes, words in Relative Index entries, and words in the first subject heading in the library's bibliographic records to find class numbers common to the matched words. DOC then grouped class numbers associated with the matched words and wound up with five groups of class numbers beginning with 332 (whose Schedule caption is Financial economics), 336 (Public finance), 338 (Production), 382 (International commerce [Foreign trade]), and 658 (General management).

```
What would you like to do? > ss
Enter subject to search > loans

>>>>> YOUR REQUEST...ss:loans

  Please wait ...
YOUR SUBJECT IS TREATED FROM 5  PERSPECTIVES:

LINE  PERSPECTIVES
   A  Financial economics
   B  Public finance
   C  Production
   D  International commerce (Foreign trade)
   E  General management

OPTION   DESCRIPTION
    BP   Browse a perspective
    SO   Start over
```

Fig. 27. List of Perspectives from the DDC Schedules in a DOC subject outline search for "loans"

DOC responds to the user with an intermediate List of Perspectives (see fig. 27). The List of Perspectives is composed of the Schedule captions of three-digit DDC class numbers; these captions provide a very general description of the class number areas where there are bibliographic records containing the words in the user-entered term. From the List of Perspectives, the user can select a listed perspective using the browse a perspective (BP) option to see the specific List of Topics where there are bibliographic records containing the words in the user-entered term (fig. 20, Menu 13). For example, the user pursuing the search in fig. 27 might choose to browse the first-listed perspective; he would be directed to the List of Topics in fig. 26. Once DOC displays the List of Topics, the user can always return to the List of Perspectives to select a different perspective using the return to perspectives (RP) option (fig. 20, Menu 14).

Once the user finds a List of Topics that addresses his topic of interest from the proper perspective, the user has the same five options as those in a call number search (fig. 20, Menus 14 and 15). The first two options are to browse more general or specific topics. Selecting one of these two options, the user views another List of Topics one level up the DDC hierarchy (i.e., with one digit subtracted from the class number) or one level down the DDC hierarchy (i.e., with one digit added to the class number). The most general level in DOC contains three-digit DDC numbers and the most specific level is where the defined DDC hierarchy ends according to the printed DDC Schedules. The third option was shown in fig. 25. There, the searcher chose a listed topic to view additional information from the DDC Schedules and Relative Index. The fourth option lets the searcher select a listed caption to display items whose class number matches or begins with the listed class number. A user selecting line B in fig. 26, which best represents the user's topic of interest, would obtain the following DOC response in which DOC saves the search results in set 4:

```
What would you like to do? > sl b

>>>>> YOUR REQUEST...sl b
      10 ITEMS IN SET 4  (332.743 Personal loans)
```

Accompanying this message is the first of ten items retrieved. The user can display the next item or return to the List of Topics after each retrieved item is displayed.

5.3.5 Bibliographic Record Display

A set of bibliographic records in DOC can be created in one of three ways: (1) the selection of entries during the browsing of the List of Aspects in an alphabetical search, (2) direct search, or (3) the selection of Schedule captions during the browsing of the List of Topics in a call number search or subject outline search. Once a set has been created, the user can display it again later in the same search session without having to repeat the search. A Summary of Searches can be requested for review using the review searches (RS) option (fig. 28).

The Summary of Searches shows the set numbers, the number of items in the sets, and the searches from which the sets were created. The sets in a session are numbered sequentially, starting with 1. The highest possible set number in a session is 10. When the 11th set is about to be created, the user is told by DOC that the seven oldest sets (i.e., sets 1-7) are being erased, the three newest (i.e., sets 8-10) are being renumbered from 1 to 3, and the set being created is numbered 4.

Only one set can be displayed at a time. At the end of displaying all the items in a set, DOC returns to the Summary of Searches. During the bibliographic record display, DOC stops at the end of each record so that the user has the chance to scan the record before asking for the next one or stopping the display altogether. DOC displays the records in increasing order of the Schedules DDC class numbers, i.e., in shelflist order. Each displayed record is preceded with "i OF n" where "i" is the record number in the set and "n" is the total number of records (see fig. 29).

```
What would you like to do? > rs

>>>>> YOUR REQUEST...rs

     THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
     SET  ITEMS     REQUEST
       1     10     sa:Personal--loans--economics
       2     12     sd:personal loans
       3     10     sc:332.743 Personal loans
       4     10     ss:332.743 Personal loans

OPTION   DESCRIPTION
    DI   Display items
    SO   Start over
```

Fig. 28. Summary of searches in DOC

The format of a bibliographic record display is shown in fig. 29. The full format of the record is the one and only format available. All the fields that are to be displayed are labeled in the Display in Bibliographic Records column of table 6. The only difference in the display of bibliographic records in SOC and DOC is that DOC's record contains one additional field entitled Dewey Subject, which contains DDC Schedule captions. Although Relative Index entries are used in DOC's alphabetical, subject outline, and direct searches, they are not displayed in records because they are indicative of a book that can be assigned a particular class number. However, the contents of a book with that class number does not necessarily contain information represented by the Relative Index entry (see also section 3.4). Notes in the DDC Schedules are used in DOC's subject outline and direct searches, but they, too, are not displayed in bibliographic records for the same reason as Relative Index entries.

Note that for Library of Congress, the LC call number is labeled "LC CALL NUMBER" and DDC call number is labeled "DEWEY NUMBER." For the other three libraries, the DDC call number is labeled "CALL NUMBER." (These three libraries' records do not contain LC call numbers.) The Collection field is labeled and listed in NYSL bibliographic records only.

```
i OF n

LC CALL NUMBER       ................................ (for LC)
CALL NUMBER          ................................ (for UI, NYSL, PLCFC)
COLLECTION           ................................ (for NYSL)
TITLE                ................................
ALTERNATE TITLE      ................................
LC SUBJECT           ................................
DEWEY SUBJECT        ................................
CONTENTS             ................................
DEWEY NUMBER         ................................ (for LC)
AUTHOR               ................................
SPONSOR              ................................
EDITION              ................................
PUBLISHER            ................................
SERIES               ................................
```

Fig. 29. Bibliographic record display in DOC

5.4 Organizational Data Structure of the Experimental Online Catalog's Database

This section describes the internal organizational data structure of the experimental online catalog's database. At times, the discussion becomes technical and may not be necessary for readers with a general interest in SOC or DOC subject searching capabilities or the results of the retrieval tests with library patrons and staff. However, online catalog system designers and library staff involved in online catalog design might find this section valuable when enhancing their online catalogs with a library classification.

5.4.1 Experimental Online Catalog's Database

Both SOC and DOC require a database to store information. A database usually includes at least one data file and several index files. (In general, there is an index file for each type of search.) The data file is a set of data records containing all essential information, such as the fields specified in table 5 for SOC or table 6 for DOC. An index file, which serves like the index of a book, is a table of searchable words and pointers to the bibliographic records bearing those searchable words. The searchable words are indexes of words or phrases derived from data records. In SOC and DOC the pointers are five-digit sequential numbers assigned to the data records. The indexes in an index file are always organized in some order, such as alphabetical or numerical order, which helps shorten the search time. Without the index file, SOC and DOC would have to search every record in the data file each time the user provides a search entry. With the index files, SOC and DOC can look for a matched index in the appropriate index file, get the pointers, and immediately locate the target records in the data file.

The SOC database is composed of one data file (i.e., bibliographic file) and three index files that point to the bibliographic file (fig. 30). A data file in fig. 30 is represented by a dark rectangle, and an index file by a light rectangle. An arrow indicates that the index file contains the pointers to the data file. (MARC refers to the data selected only from machine-readable cataloging records received from the four participating libraries in the DDC Online Project.)

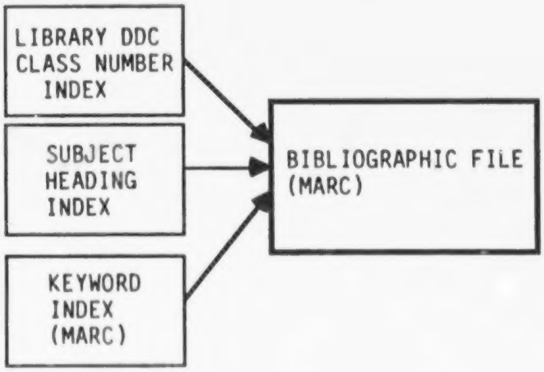


Fig. 30. SOC database

Each file in the SOC database is used for the following purpose:

File	Purpose
Bibliographic file	Display of bibliographic records
Library DDC class number index	Call Number search (SC)
Subject heading index	Alphabetical search (SA)
Keyword index	Direct search (SD)

The DOC database consists of two data files (i.e., the bibliographic file and the topic file), three index files that point to the bibliographic file, and two index files that point to the topic file (see fig. 31). (DDC refers to the data selected from the machine-readable DDC supplied by Inforonics.)

The files in the DOC database are used for these purposes:

File	Purpose
Bibliographic file	Display of bibliographic records
Topic file	Display of DDC Schedules
Schedules DDC class number index	Call number search (SC) and subject outline search (SS)
DDC Relative Index entry index	Alphabetical search (SA)
Keyword index	Direct search (SD)
DDC class number index	Call number search (SC) and subject outline search (SS)
Topic keyword index	Subject outline search (SS)

The organization of the data in figures 30 and 31 shows that the SOC and DOC databases overlap in some areas. DOC's bibliographic file is the combination of the fields extracted from the MARC records (which is equivalent to SOC's bibliographic file) and the DDC information. DOC's keyword index is composed of the indexes from the fields originally from MARC records (which are also used for SOC) and the indexes from the DDC information. To eliminate redundant information and, thus, reduce the required storage area, the two databases have been combined. This database combination is shown in fig. 32.

We needed both experimental online catalogs SOC and DOC to conduct the retrieval experiments with library patrons and staff. In a production environment, however, two systems would not be needed. Thus, the combined database of the experimental online catalog shown in fig. 32 served our purposes and is not our recommendation of how to structure a DOC-like system in a production environment. Recommendations for searching and displaying a library classification in an online catalog are provided in section 9.5.

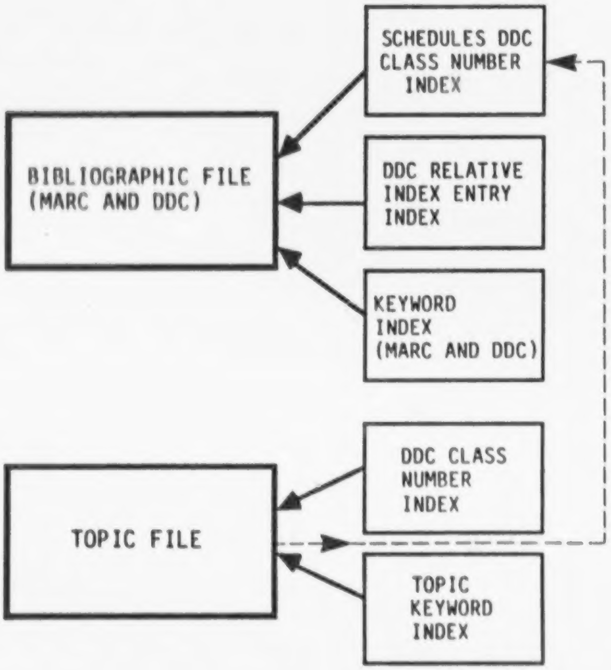

SCHEDULES DDC CLASS NUMBER INDEX
BIBLIOGRAPHIC FILE (MARC AND DDC)
DDC RELATIVE INDEX ENTRY INDEX
KEYWORD INDEX (MARC AND DDC)
DDC CLASS NUMBER INDEX
TOPIC FILE
TOPIC KEYWORD INDEX

Fig. 31. DOC database

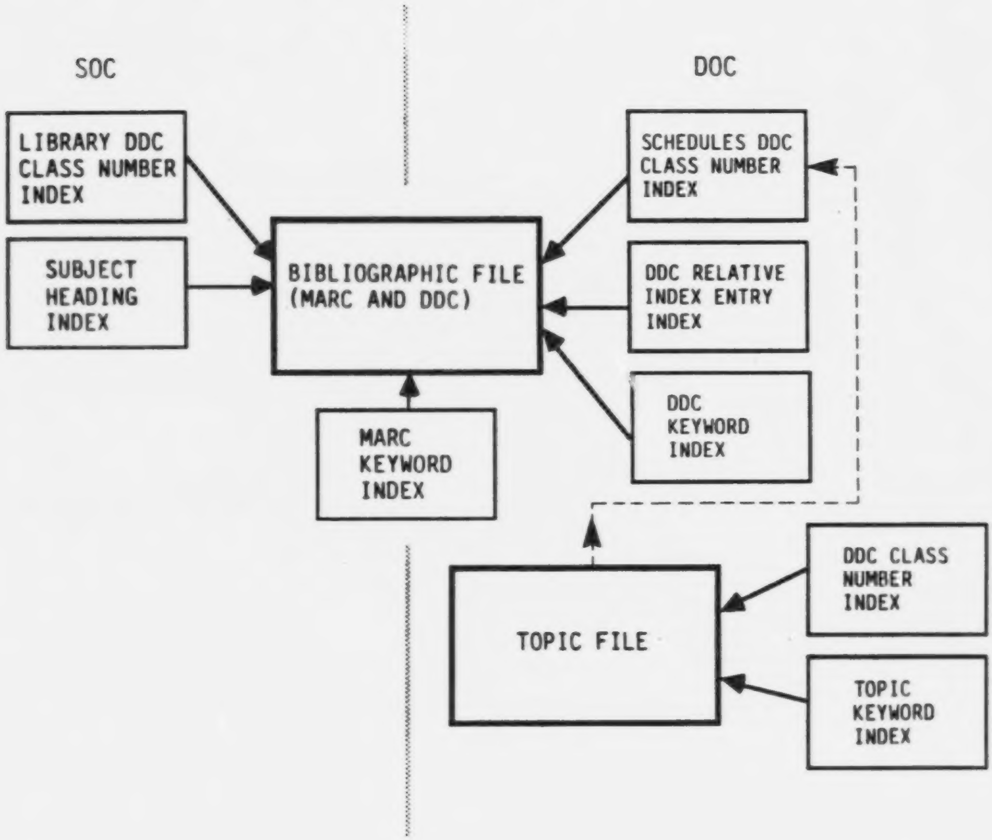

SOC
DOC
LIBRARY DDC CLASS NUMBER INDEX
SUBJECT HEADING INDEX
BIBLIOGRAPHIC FILE (MARC AND DDC)
MARC KEYWORD INDEX
SCHEDULES DDC CLASS NUMBER INDEX
DDC RELATIVE INDEX ENTRY INDEX
DDC KEYWORD INDEX
TOPIC FILE
DDC CLASS NUMBER INDEX
TOPIC KEYWORD INDEX

Fig. 32. Combined database of the experimental online catalog

There are two files, the bibliographic file and the MARC keyword index, which are used by both SOC and DOC (see fig. 32). The bibliographic file, equivalent to DOC's bibliographic file (fig. 31), substitutes for SOC's bibliographic file (fig. 30). The MARC keyword index, equivalent to SOC's keyword index (fig. 30), is used as part of DOC's keyword index (fig. 31). The remaining part of DOC's keyword index is the DDC keyword index. The rest of the files from SOC and DOC in figures 31 and 32 constitute the remaining part of the combined database. The structure of the experimental online catalog's data files and index files are covered in sections 5.4.2-5.4.3.

5.4.2 Experimental Online Catalog's Data Files

5.4.2.1 Bibliographic File (in SOC and DOC)

The bibliographic file is a collection of bibliographic records, each of which represents one item or book. These records are accessed with a five-digit sequential number called bibliographic record number. If an index file is analogous to the index of a book, then the bibliographic file is analogous to the book (which contains one record per page), and the bibliographic record numbers are analogous to the page numbers. The records in the bibliographic file are in random order; the order in which they are displayed is manipulated by SOC and DOC during the search session (and corresponds to shelflist order). Since the bibliographic file is designed to be used for both SOC and DOC, it contains all the fields specified in tables 5 and 6. The search procedures in SOC and DOC identify which fields are used in which catalog by keeping a table of valid fields for each catalog. The following bibliographic record fields are present in the bibliographic file:

Bibliographic record number
DDC call number
Library DDC class number (used in SOC only)
Schedules DDC class number (used in DOC only)
LC class number
Collection
Title
Alternate title
Title added
LC subject
Genre
Subheading
DDC caption (used in DOC only)
DDC notes (used in DOC only)
DDCRI (Relative Index) entry (used in DOC only)
Contents
Author
Sponsor
Edition
Publisher
Series
Series title
Series added

The notes from the DDC Schedules chosen for the bibliographic file are example notes, including notes, class here notes, and other types of notes (see DOC Bibliographic Record column of table 1).

Following is an example of a record in the bibliographic file. The right-hand column is not part of the record; it is included only to show the names of the data fields in the left-hand column.

Bibliographic Record	Field Label
02345	Bibliographic record number
332.743	Library DDC class number
Credit, get it, use it, stretch it, save it	Title
Consumer credit--Handbooks, manuals, etc.	LC subject
Other forms of credit. Personal loans.	Dewey subject
Johnson, Bert	Author
San Francisco: Harbor Pub.; [New York]: Distributed by Putnam, c1981.	Publisher

5.4.2.2 Topic File (in DDC Only)

The topic file is a collection of subject-rich records containing subject information associated with every DDC class number in the Schedules, viz., DDC Schedules caption, DDC Schedule notes, DDC Relative Index entries, and the first subject heading in a bibliographic record. These records can be accessed with a five-digit sequential number called topic record number. If an index file is analogous to the index of a book, the topic file is analogous to the book (which contains one record per page), and the topic record numbers are analogous to the page numbers. The records in the topic file are in random order; the browsing procedures in DDC are responsible for the order in which the records are displayed.

The fields in each record are the following:

Topic record number
DDC class number
DDC caption
DDC notes
DDCRI (Relative Index) entry
LC subject

The DDC notes in the topic file are examples notes, including notes, class here notes, optional provisions notes, standard subdivisions exceptions notes, discontinued numbers and topics notes, relocation notes, and other types of notes (see DDC Schedule Record column of table 1).

The following is an example of a topic record. Only the left-hand column shows the contents of the actual record; the right-hand column is included only to show the names of the data fields in the left-hand column.

Topic Record	Field Label
00136	Topic record number
332.743	DDC class number
Personal loans	DDC caption
Including chattel mortgage, consumer credit	Including note
Consumer--credit--economics	DDCRI entry
Pawnbroking--economics	DDCRI entry
Personal--loans--economics	DDCRI entry

Secured transactions--credit economics	DDCRI entry
Consumer credit	LC subject
Consumer credit--Canada	LC subject
Consumer credit--Handbooks, manuals, etc.	LC subject
Consumer credit--Study and teaching--Handbooks, manuals, etc.	LC subject
Consumer credit--United States--Congresses	LC subject
Home improvement loans--United States	LC subject
Loans, Personal--Handbooks, manuals, etc.	LC subject

5.4.3 Experimental Online Catalog's Index Files

5.4.3.1 Library DDC Class Number Index (in SOC Only)

The library DDC class number index is derived from the field marked "SC" in the Search column of table 5 and is used for the call number search in SOC. When SOC indexes library DDC class numbers in bibliographic records, one index entry is made for the library DDC class number and one index entry is made for this class number with its last digit truncated until the class number is made up of three digits. For example, four index entries are made for the library DDC class number 332.743: 332.743, 332.74, 332.7, and 332.

The library DDC class number index contains one record for each library DDC class number or its truncated numbers from the bibliographic file. The records are kept in ascending order of the library DDC class numbers. Each record has three fields:

1. DDC class number (i.e., library DDC class number or its truncated number)
2. Number of items classed under this DDC class number
3. Bibliographic record numbers pointing to these items in the bibliographic file

For example:

Class Number	Number of Items	Bibliographic Record Numbers
•	•	•
•	•	•
•	•	•
332.74	12	01827 01847 02335 02345 02837 03736 03746 03863 06372 07049 08473 09463
332.742	20	01827 02345
332.743	10	01847 02335 02837 03736 03746 03863 06372 07049 08473 09463
332.7430202	1	09463
332.75	3	02827 03747 04646
•	•	•
•	•	•
•	•	•

5.4.3.2 Subject Heading Index (in SOC Only)

The subject heading index is derived from the field marked SA in the Search column of table 5 and is used for SOC's alphabetical search. Subject headings are indexed according to a library-text indexing method. That is, each subject heading is treated as one index entry. (However, SOC uses only the first sixty characters of a subject heading as one index entry for the reasons discussed in section 5.2.1.) Letters in upper- and lowercase are considered the same letters.

The indexes in the subject heading index are kept in alphabetical order. For each subject heading in the bibliographic file, there is a record in the subject heading index that contains the following:

Subject heading (the first sixty characters)
Number of items bearing this subject heading
Bibliographic record numbers pointing to these items in the bibliographic file

Subject Heading	Number of Items	Bibliographic Record Numbers
●	●	●
●	●	●
●	●	●
Loans, Foreign--Statistics	1	05362
Loans, Personal--Great Britain--History	1	07365
Loans, Personal--Handbooks, manuals, etc.	2	02345 09463
●	●	●
●	●	●
●	●	●

5.4.3.3 MARC Keyword Index (in SOC and DOC)

The MARC keyword index is used for the direct search in both SOC and DOC. (Note that DOC needs an additional index file called DDC keyword index for this search.) The MARC keyword index is created from the fields that originally come from MARC records: title, alternate title, title added, LC subject, genre, subheading, contents, sponsor, series, series title, and series added. These fields are marked with SD in the Search column of tables 5 and 6.

A word suitable for indexing is a contiguous string of characters between blanks, hyphens, underscores, and apostrophes. Stopwords and one-letter words are ignored. (See appendix E for the list of stopwords used in SOC and DOC.) Upper- and lowercase letters are considered the same. The indexed words in the MARC keyword index are in alphabetical order. For each word in the selected indexed fields in the bibliographic file, there is a record in the MARC keyword index that contains:

Word (from the indexed fields in the bibliographic file)
Number of items containing this word
Bibliographic record numbers pointing to these items in the bibliographic file

Word	Number of Items	Bibliographic Record Numbers
●	●	●
●	●	●
●	●	●
live	92	03847 03973 04375 04394 04438 ...
living	109	03973 04438 05837 05938 06392 ...
loans	121	02345 05362 05486 05578 07365 ...
●	●	●
●	●	●
●	●	●

5.4.3.4 Schedules DDC Class Number Index (in DOC Only)

The Schedules DDC class number index, derived from the field marked with SC in the Search column of table 6, is used to support DOC's call number search and subject outline search. The indexing method here is identical to that of the library DDC class number index in SOC. That is, one index entry is made for the Schedules DDC class number, and one index entry is made for this same class number with its last digit truncated until the class number is made up of three digits. For example, four entries are made for the Schedules DDC class number 332.743: 332.743, 332.74, 332.7, and 332.

The indexes in the Schedules DDC class number index are in increasing order of the DDC class numbers. Each Schedules DDC class number or its truncated number is represented by a record in the Schedules DCC class number index which contains the following:

DDC class number (i.e., Schedules DDC class number or its truncated number)
Number of items classed under this DDC class number
Bibliographic record numbers pointing to these items in the bibliographic file

Class Number	Number of Items	Bibliographic Record Numbers
●	●	●
●	●	●
●	●	●
332.74	12	01827 01847 02335 02345 02837 03736 03746 03863 06372 07049 08473 09463
332.742	2	01827 02345
332.743	10	01847 02335 02837 03736 03746 03863 06372 07049 08473 09463
332.7430202	1	09463
332.75	3	02827 03747 04646
●	●	●
●	●	●
●	●	●

5.4.3.5 DDC Relative Index Entry (in DOC only)

The DDC Relative Index entry index, derived from the DDC Relative Index entry field marked with SA in the Search column of table 6, is used for the alphabetical search in DOC. The indexing method here is identical to that of the subject heading index. That is, each Relative Index entry is treated as one index entry. (However, DOC uses only the first sixty characters of a Relative Index entry as one index entry for the reason discussed in section 5.3.1.) Letters in upper- and lowercase are considered the same letters.

These index entries are arranged in alphabetical order. For each DDC Relative Index entry that has been added to the bibliographic file, there exists a record in the DDC Relative Index entry index which contains the following:

> DDC Relative Index entry (the first sixty characters of the entry)
> Number of items bearing this DDC Relative Index entry
> Bibliographic record numbers pointing to these items in the bibliographic file

Relative Index Entry	Number of Items	Bibliographic Record Numbers
●	●	●
●	●	●
●	●	●
Personal--income--macroeconomics	1	07362
Personal--income--tax reductions--public finance	1	03842
Personal--loans--economics	10	01847 02345 02837 ...
●	●	●
●	●	●
●	●	●

5.4.3.6 DDC Keyword Index (in DOC Only)

The DDC keyword index is used in conjunction with the MARC keyword index for DOC's direct search. The DDC keyword index contains words from the fields that originally came from the DDC Schedules and Relative Index: DDC caption, DDC notes, and DDC Relative Index entry. These are the fields marked with SD in the Search column of table 6, excluding those already indexed in the MARC keyword index. The indexing method used here is the same as that used in the MARC keyword index. A word suitable for indexing is a contiguous string of characters between blanks, hyphens, underscores, and apostrophes. Stopwords and one-letter words are ignored. (See appendix E for the list of stopwords used in SOC and DOC.) Upper- and lowercase letters are considered the same letters.

The indexed words in the DDC keyword index are in alphabetical order. For each word in the selected indexed fields from the bibliographic file, there is a record in the DDC keyword index that contains the following:

Word (from the indexed fields in the bibliographic file)
Number of items containing this word
Bibliographic record numbers pointing to these items in the bibliographic file

Word	Number of Items	Bibliographic Record Numbers
•	•	•
•	•	•
•	•	•
lending	34	01837 02783 03847 04862 04937 ...
loans	98	02345 05362 05486 05578 07365 ...
•	•	•
•	•	•
•	•	•

5.4.3.7 DDC Class Number Index (in DOC Only)

The DDC class number index is used in DOC's call number and subject outline searches to locate a record in the topic file with a given DDC number. A DDC class number in the topic file is used as one index entry.

The DDC class number index is organized in increasing order of the DDC class numbers. For each DDC class number in the topic file (or the DDC Schedules), there is a record in the DDC class number index that contains the following:

DDC class number (from the topic file)
Number of such DDC class numbers in the topic file, which is always equal to one because DDC class numbers are unique in the DDC Schedules
Topic record number pointing to the record in the topic file

Example:

DDC Class Number	Number of Items	Topic Record Number
•	•	•
•	•	•
•	•	•
332.742	1	00135
332.743	1	00136
332.75	1	00137
•	•	•
•	•	•
•	•	•

5.4.3.8 Topic Keyword Index (in DOC Only)

The topic keyword index is used along with the Schedules DDC class number index, DDC class number index, and topic file in DOC's subject outline search. Creating the topic keyword index from the topic file is identical to creating the MARC or DDC keyword index from the bibliographic file.

The topic keyword index contains keywords from the DDC Schedules caption and notes, DDC Relative Index, and first subject heading in bibliographic records. These fields are marked with SS in the Search column of table 6. The indexing method used here is the same as that for the MARC keyword index and DDC keyword index. A word suitable for indexing is a contiguous string of characters between blanks, hyphens, underscores, and apostrophes. Stopwords and one-letter words are ignored. (See appendix E for the list of stopwords used in SOC and SOC.) Upper- and lowercase letters are considered the same letters.

The indexed words in the topic keyword index are in alphabetical order. For each word in the selected indexed fields in the topic file, there is a record in the DDC keyword index that contains the following:

Word (from all the fields in the topic file)
Number of subject records containing this word
Topic record numbers pointing to the topic file

Word	Number of Items	Topic File Numbers
•	•	•
•	•	•
•	•	•
loans	9	00136 00173 00264 00675 00876 00965 00977 00989 01011
local	7	00187 00283 00387 00764 00854 00975 01019
•	•	•
•	•	•
•	•	•

5.5 Search Procedures in the Experimental Online Catalog

5.5.1 Search Procedures in SOC

In this section, a technical description shows how SOC accesses its one data file and three index files during the subject searching process. The contents of this section are supported by section 4.4.2 on the bibliographic record data selected for the SOC database, section 5.2 on subject searching in SOC, and section 5.4 on the organizational structure of the SOC and DOC databases.

The three subject searches and the one display of bibliographic data in SOC are featured separately in sections 5.5.1.1-5.5.1.4. Each subject search or display is described in a step-by-step fashion and accompanied by a figure to diagram the search process. The forms used in the figures are (1) a rectangle to represent a data or index file in the database, (2) a circle to represent a process, and (3) a rectangle with rounded corners to represent a screen display of information presented to the SOC searcher. Arrows indicate the flow of information between various forms. The numbers enclosed in brackets are the step numbers from the description of the search process in the text.

5.5.1.1 Alphabetical Search

The alphabetical search in SOC is shown in fig. 33. SOC does the following to perform the alphabetical search:

1. Locates the user-entered term in the subject heading index.

2. Moves up two lines in the subject heading index.

3. Displays the List of Aspects, i.e., ten lines of data labeled A through J, by
    a. Getting the number of items and subject heading at the current line from the subject heading index.
    b. Displaying the number of items from step 3.a in the ITEMS column of the List of Aspects.
    c. Displaying the subject heading from step 3.a in the TOPICS--ASPECTS column of the List of Aspects.
    d. Moving down one line in the subject heading index.
    e. Repeating steps 3.a-3.d above until ten lines have been displayed.

(At this point, the searcher is presented with a screen display and list of options. The searcher who selects a listed subject heading triggers steps 4-6 in SOC in which SOC prepares to display items.)

4. Combines the bibliographic record numbers from all selected lines through a Boolean OR operation.

5. Counts the number of bibliographic record numbers in step 4 and displays this number as the result of the selection.

6. Sends the bibliographic record numbers obtained in step 4 to the bibliographic display function (which is discussed in section 5.5.1.4) and saves the bibliographic record numbers for the display of records at some later time.

(When the searcher browses up and down the alphabetically arranged List of Aspects, SOC displays another portion of the subject heading index, which is adjacent to the portion currently displayed.)

5.5.1.2 Direct Search

The direct search in SOC is shown in fig. 34. SOC does the following to perform the direct search:

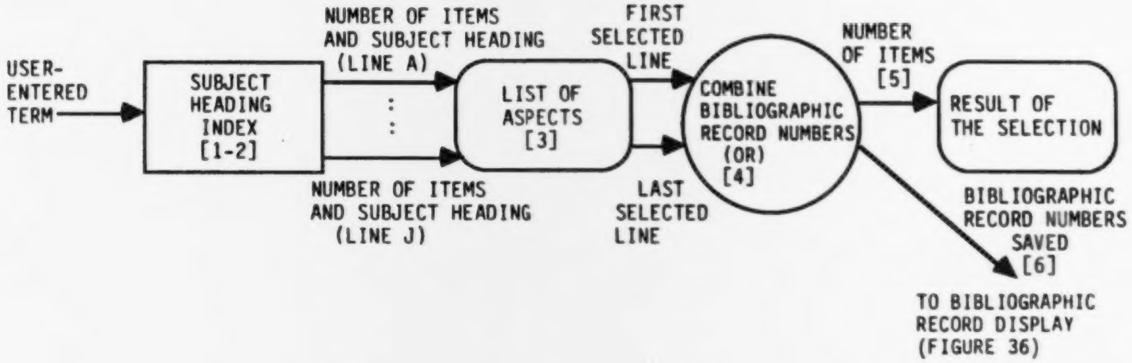

USER-ENTERED TERM
SUBJECT HEADING INDEX [1-2]
NUMBER OF ITEMS AND SUBJECT HEADING (LINE A)
NUMBER OF ITEMS AND SUBJECT HEADING (LINE J)
LIST OF ASPECTS [3]
FIRST SELECTED LINE
LAST SELECTED LINE
COMBINE BIBLIOGRAPHIC RECORD NUMBERS (OR) [4]
NUMBER OF ITEMS [5]
RESULT OF THE SELECTION
BIBLIOGRAPHIC RECORD NUMBERS SAVED [6]
TO BIBLIOGRAPHIC RECORD DISPLAY (FIGURE 36)

Fig. 33. Alphabetical search in SOC

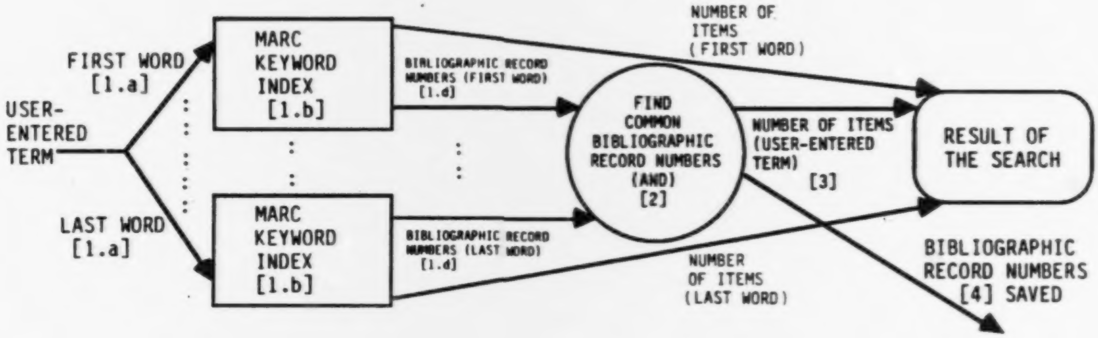

USER-ENTERED TERM
FIRST WORD [1.a]
LAST WORD [1.a]
MARC KEYWORD INDEX [1.b]
MARC KEYWORD INDEX [1.b]
BIBLIOGRAPHIC RECORD NUMBERS (FIRST WORD) [1.d]
BIBLIOGRAPHIC RECORD NUMBERS (LAST WORD) [1.d]
FIND COMMON BIBLIOGRAPHIC RECORD NUMBERS (AND) [2]
NUMBER OF ITEMS (FIRST WORD)
NUMBER OF ITEMS (USER-ENTERED TERM) [3]
NUMBER OF ITEMS (LAST WORD)
RESULT OF THE SEARCH
BIBLIOGRAPHIC RECORD NUMBERS [4] SAVED

Fig. 34. Direct search in SOC

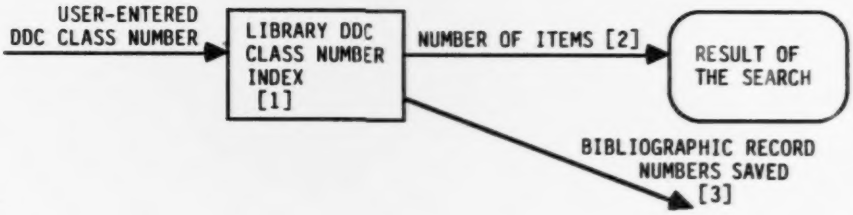

USER-ENTERED DDC CLASS NUMBER
LIBRARY DDC CLASS NUMBER INDEX [1]
NUMBER OF ITEMS [2]
RESULT OF THE SEARCH
BIBLIOGRAPHIC RECORD NUMBERS SAVED [3]

Fig. 35. Call number search in SOC

1. From the first to the last word in the user-entered term:
    a. Extracts a word from the user-entered term (excluding stopwords and one-letter terms).
    b. Uses the word from step 1.a to get the number of items and bibliographic record numbers from the MARC keyword index.
    c. Displays to the searcher the number of items from step 1.b as an intermediate result.
    d. Saves the bibliographic record numbers from step 1.b in a temporary set.
    e. Repeats steps 1.a-1.d above until all the words in the user-entered term have been searched.
2. Finds the bibliographic record numbers that are common to all temporary sets created in step 1.d through a Boolean AND operation.
3. Counts the number of bibliographic record numbers obtained in step 2 and displays the total number as the number of items retrieved for the user-entered term.
4. Saves the common bibliographic record numbers obtained in step 2 in a set for the display of records at some later time.

5.5.1.3 Call Number Search

The call number search in SOC is shown in fig. 35. SOC does the following to perform the call number search:

1. Uses the user-entered DDC class number to retrieve the number of items and the bibliographic record numbers from the library DDC class number index.
2. Displays the number of items from step 1 on the screen.
3. Saves the bibliographic record numbers from step 1 in a set for the display of records at some later time.

5.5.1.4 Display of Bibliographic Records

The display of bibliographic records can be performed after a set of bibliographic record numbers has been saved as the result of a call number search or direct search or after the selection of line(s) from the List of Aspects in the alphabetical search. The display of bibliographic records is shown in fig. 36. SOC does the following to display records:

1. From the first to the last bibliographic record numbers in the saved set:
    a. Gets a bibliographic record number from the saved set.
    b. Uses the bibliographic record number obtained in 1.a to get the records from the bibliographic file.

c. Displays the fields of the record with the labels specified in the Display in Bibliographic Records column of table 5 (for SOC) and table 6 (for DOC).
d. Repeats steps 1.a-1.c above until all the bibliographic record numbers in the saved set have been processed.

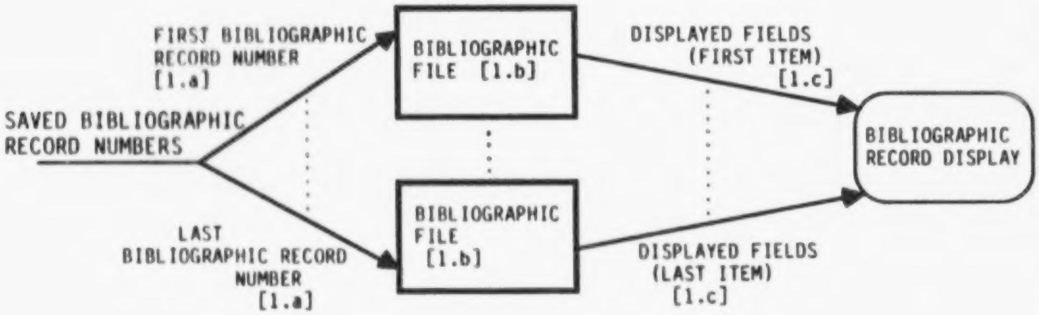

FIRST BIBLIOGRAPHIC RECORD NUMBER [1.a]
SAVED BIBLIOGRAPHIC RECORD NUMBERS
LAST BIBLIOGRAPHIC RECORD NUMBER [1.a]
BIBLIOGRAPHIC FILE [1.b]
BIBLIOGRAPHIC FILE [1.b]
DISPLAYED FIELDS (FIRST ITEM) [1.c]
DISPLAYED FIELDS (LAST ITEM) [1.c]
BIBLIOGRAPHIC RECORD DISPLAY

Fig. 36. Bibliographic record display in SOC or DOC

5.5.2 Search Procedures in DOC

In this chapter, a technical description shows how DOC accesses its two data files and five index files during the subject searching process. The contents of this section are supported by section 4.3 on the DDC, section 4.4.3 on the bibliographic record data selected for the DOC database, section 5.3 on subject searching in DOC, and section 5.4 on the organizational structure of the SOC and DOC databases.

The four subject searches and the two displays of DDC and bibliographic data in DOC are featured separately in sections 5.5.2.1-5.5.2.5. Each subject search or display is described in a step-by-step fashion and accompanied by a figure that diagrams the search process. The forms used in the following figures represent the same functions as those used above in 5.5.1.1-5.5.1.4; that is, (1) a rectangle represents a data or index file in the database, (2) a circle represents a process, and (3) a rectangle with rounded corners represents a screen display of information presented to the DOC searcher. Arrows indicate the flow of information between various forms. The numbers enclosed in brackets are the step numbers from the description of the search process in the text.

5.5.2.1 Alphabetical Search

The alphabetical search in DOC is shown in fig. 37. DOC's alphabetical search is identical to SOC's alphabetical search with one exception: DOC accesses the DDC Relative Index entry index and SOC accesses the subject heading index.

DOC does the following to perform an alphabetical search:

1. Locates the user-entered term in the DDCRI (Relative Index) entry index.

2. Moves up two lines in the DDCRI entry index.

3. Displays the List of Aspects, i.e., ten lines of data labeled A through J, by

   a. Getting the number of items and DDCRI entry at the current line from the DDCRI.
   b. Displaying the number of items from the preceding step (step 3.a) in the ITEMS column of the List of Aspects.
   c. Displaying the DDCRI entry from step 3.a above in the TOPICS--ASPECTS column of the List of Aspects.
   d. Moving down one line in the DDCRI entry index.
   e. Repeating steps 3.a-3.d until ten lines have been displayed.

(At this point the searcher is presented with a screen display and list of options. The searcher who selects a listed Relative Index entry triggers steps 4-6 below, i.e., the steps DOC takes to display items.)

4. Combines the bibliographic record numbers from all selected lines through a Boolean OR operation.

5. Counts the number of bibliographic record numbers in step 4 and displays this number as the result of the selection.

6. Sends the bibliographic record numbers obtained from step 4 to the bibliographic display function (which is discussed in section 5.5.1.4) and saves the bibliographic record numbers for the display of records at some later time.

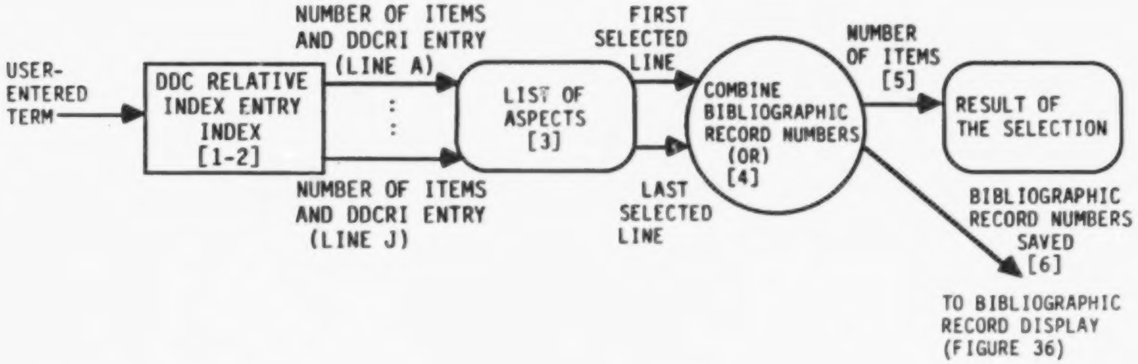

USER-ENTERED TERM
DDC RELATIVE INDEX ENTRY INDEX [1-2]
NUMBER OF ITEMS AND DDCRI ENTRY (LINE A)
:
:
NUMBER OF ITEMS AND DDCRI ENTRY (LINE J)
LIST OF ASPECTS [3]
FIRST SELECTED LINE
LAST SELECTED LINE
COMBINE BIBLIOGRAPHIC RECORD NUMBERS (OR) [4]
NUMBER OF ITEMS [5]
RESULT OF THE SELECTION
BIBLIOGRAPHIC RECORD NUMBERS SAVED [6]
TO BIBLIOGRAPHIC RECORD DISPLAY (FIGURE 36)

Fig. 37. Alphabetical search in DOC

(When the searcher browses up and down the alphabetically arranged List of Aspects, DOC displays another portion of the DDC Relative Index entry index, which is adjacent to the portion currently displayed.)

5.5.2.2 Direct Search

The direct search in DOC is shown in fig. 38. DOC's direct search is identical to SOC's direct search with one exception: DOC must access two index files (MARC keyword index and DDC keyword index) during the direct search. DOC does the following to perform a direct search:

1. From the first to the last word in the user-entered term:

    a. Extracts a word from the user-entered term (excluding stopwords and one-letter terms).
    b. Uses the word from step 1.a to get the bibliographic record numbers from the MARC keyword index.
    c. Uses the (same) word from step 1.a to get the bibliographic record numbers from the DDC keyword index.
    d. Combines all the bibliographic record numbers from steps 1.b and 1.c through a Boolean OR operation.
    e. Counts the number of bibliographic record numbers in step 1.d and displays the number of items for the searcher as an intermediate result.
    f. Saves the bibliographic record numbers from step 1.d in a temporary set.
    g. Repeats steps 1.a-1.f until all the words in the user-entered term have been processed.

2. Finds the bibliographic record numbers that are common to all temporary sets in step 1.f above through the Boolean AND operation.

3. Counts the number of bibliographic record numbers obtained in the preceding step (step 2) and displays the number as the number of items retrieved for the user-entered term.

4. Saves the common bibliographic record numbers obtained in step 2 above in a set for the display of records at some later time.

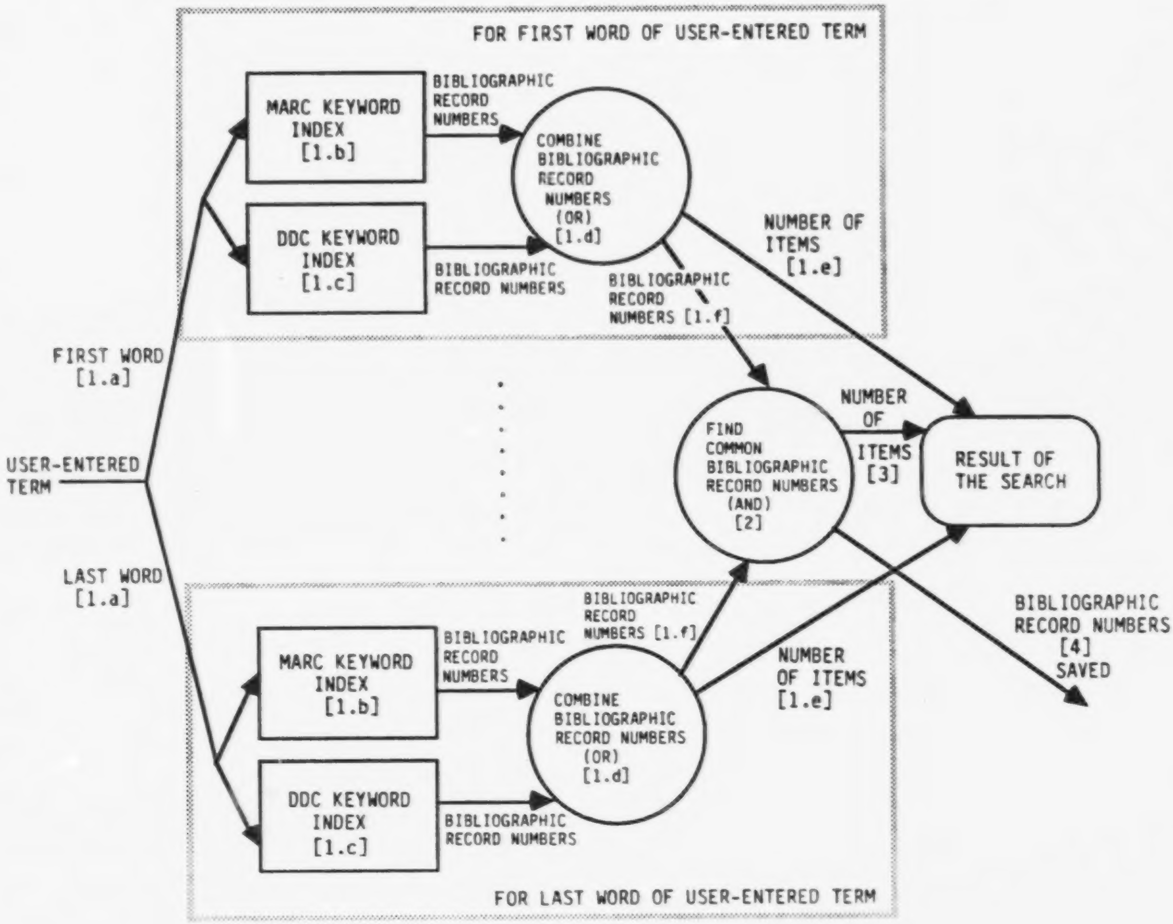

FOR FIRST WORD OF USER-ENTERED TERM
MARC KEYWORD INDEX [1.b]
BIBLIOGRAPHIC RECORD NUMBERS
COMBINE BIBLIOGRAPHIC RECORD NUMBERS (OR) [1.d]
DDC KEYWORD INDEX [1.c]
BIBLIOGRAPHIC RECORD NUMBERS
NUMBER OF ITEMS [1.e]
BIBLIOGRAPHIC RECORD NUMBERS [1.f]
FIRST WORD [1.a]
USER-ENTERED TERM
LAST WORD [1.a]
FIND COMMON BIBLIOGRAPHIC RECORD NUMBERS (AND) [2]
NUMBER OF ITEMS [3]
RESULT OF THE SEARCH
BIBLIOGRAPHIC RECORD NUMBERS [4] SAVED
BIBLIOGRAPHIC RECORD NUMBERS [1.f]
MARC KEYWORD INDEX [1.b]
BIBLIOGRAPHIC RECORD NUMBERS
COMBINE BIBLIOGRAPHIC RECORD NUMBERS (OR) [1.d]
NUMBER OF ITEMS [1.e]
DDC KEYWORD INDEX [1.c]
BIBLIOGRAPHIC RECORD NUMBERS
FOR LAST WORD OF USER-ENTERED TERM

Fig. 38. Direct search in DOC

5.5.2.3 Call Number Search

The call number search is shown in fig. 39. The call number search requires three major actions: (1) derive the DDC class numbers to be used in the List of Topics; (2) display the heading of the List of Topics; and (3) display the body of the List of Topics composed of DDC Schedule captions. DOC does the following to perform a call number search:

1. Derives the DDC class numbers (see the circle in fig. 39) by

    a. Making the base DDC class number by truncating the last digit from the user-entered DDC class number.
    b. If the base DDC class number is longer than two digits, it is used for the heading of the List of Topics. Otherwise, there is no heading.

   c. Adding a digit (from 0 to 9) to the base DDC class number from step 1.a. If such a DDC class number exists in the DDC class number index (i.e., the DDC Schedules), it is used for a line in the body of the List of Topics; otherwise, it is ignored. A List of Topics, therefore, is at most ten lines long.

2. Displays the heading of the List of Topics (see the top box in fig. 39) by

   a. Using the DDC class number from step 1.b above to get the topic record number from the DDC class number index.
   b. Using the topic record number in step 2.a to get the DDC caption from the topic file.
   c. Displaying the heading of the List of Topics by using the DDC class number used in step 2.a and the DDC caption from the record in step 2.b.

3. Displays the body of the List of Topics (see the boxes in the lower half of fig. 39) by

   a. Getting a valid DDC class number from step 1.c.
   b. Using the DDC class number in step 3.a to get the number of items from the Schedules DDC class number index and displaying this number in the ITEMS column of the List of Topics.
   c. Displaying the DDC class number from step 3.a in the AREA or LOCATION column of the List of Topics.
   d. Using the DDC class number obtained in step 3.a to get the topic record number from the DDC class number index.
   e. Using the topic record number obtained in step 3.d to get the DDC caption from the topic file, and display it in the TOPIC column of the List of Topics.
   f. Repeating step 3.a-3.e until all the valid DDC class numbers in step 1.c have been processed.

(When the user browses up and down the List of Topics, DOC displays another level of the DDC Schedules either above or below the level currently on the screen.)

5.5.2.4 Subject Outline Search

The subject outline search is shown in fig. 40. DOC does the following to perform the subject outline search:

1. From the first to the last word in the user-entered term:

   a. Gets a word from the user-entered term (excluding stopwords and one-letter terms).
   b. Uses the word from step 1.a to get the topic record numbers from the topic keyword index.
   c. Saves the topic record numbers from step 1.b in a temporary set.
   d. Repeats steps 1.a-1.c until all the terms in the user-entered term have been processed.

2. Finds the topic record numbers that are common among the temporary sets from step 1.c through the Boolean AND operation.

3. Uses the common topic record numbers found in step 2 to get the DDC class numbers from the topic file.

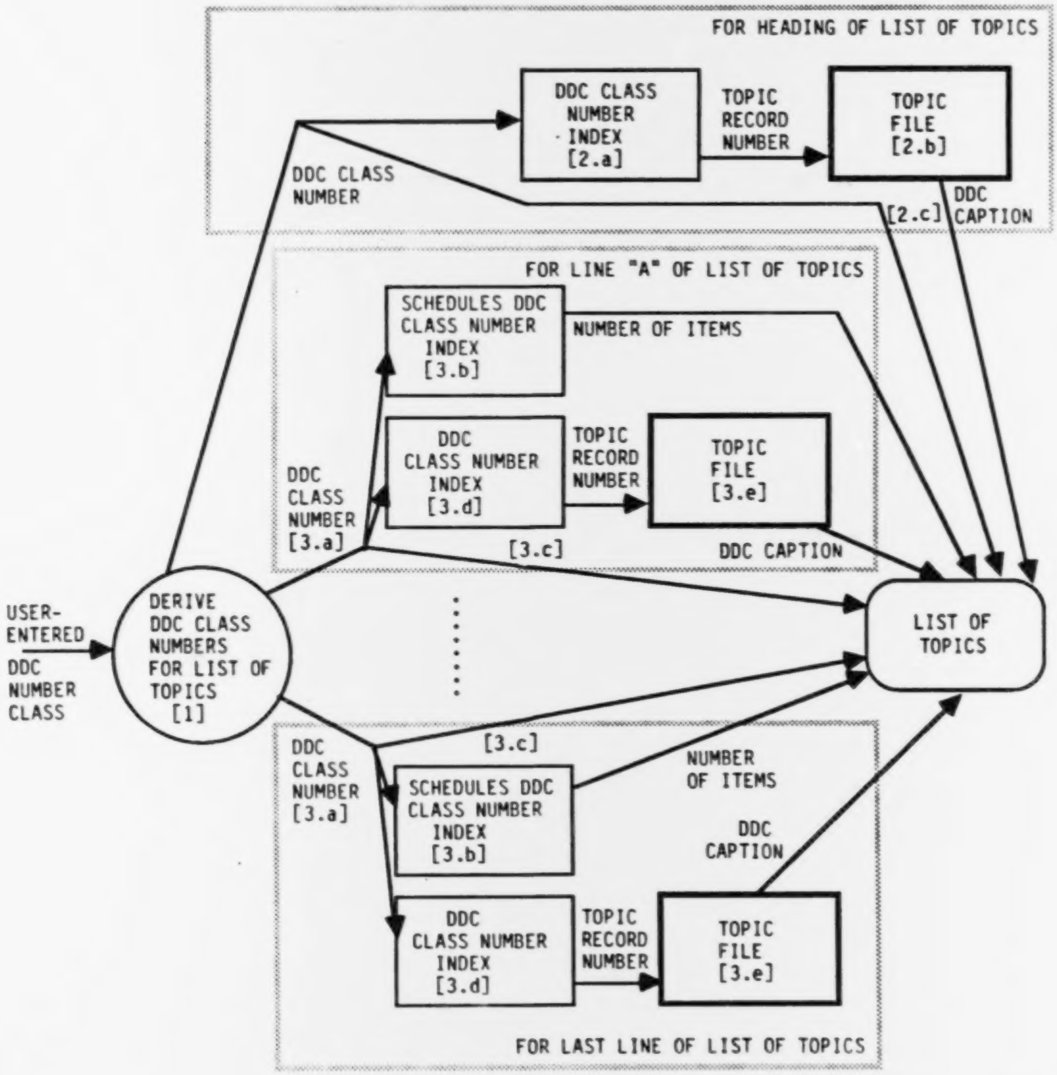

FOR HEADING OF LIST OF TOPICS
DDC CLASS NUMBER INDEX [2.a]
TOPIC RECORD NUMBER
TOPIC FILE [2.b]
DDC CLASS NUMBER
[2.c]
DDC CAPTION
FOR LINE "A" OF LIST OF TOPICS
SCHEDULES DDC CLASS NUMBER INDEX [3.b]
NUMBER OF ITEMS
DDC CLASS NUMBER INDEX [3.d]
TOPIC RECORD NUMBER
TOPIC FILE [3.e]
DDC CLASS NUMBER [3.a]
[3.c]
DDC CAPTION
USER-ENTERED DDC NUMBER CLASS
DERIVE DDC CLASS NUMBERS FOR LIST OF TOPICS [1]
LIST OF TOPICS
[3.c]
DDC CLASS NUMBER [3.a]
SCHEDULES DDC CLASS NUMBER INDEX [3.b]
NUMBER OF ITEMS
DDC CAPTION
DDC CLASS NUMBER INDEX [3.d]
TOPIC RECORD NUMBER
TOPIC FILE [3.e]
FOR LAST LINE OF LIST OF TOPICS

Fig. 39. Call number search in DOC

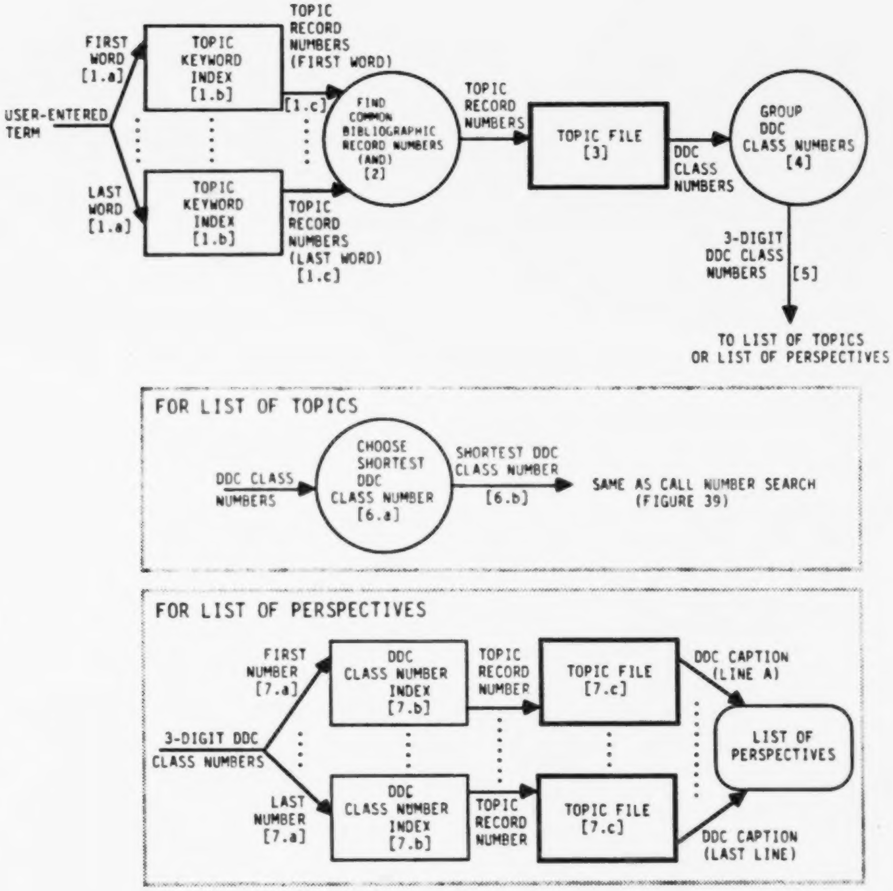

FIRST WORD [1.a]
USER-ENTERED TERM
LAST WORD [1.a]
TOPIC KEYWORD INDEX [1.b]
TOPIC KEYWORD INDEX [1.b]
TOPIC RECORD NUMBERS (FIRST WORD) [1.c]
TOPIC RECORD NUMBERS (LAST WORD) [1.c]
FIND COMMON BIBLIOGRAPHIC RECORD NUMBERS (AND) [2]
TOPIC RECORD NUMBERS
TOPIC FILE [3]
DDC CLASS NUMBERS
GROUP DDC CLASS NUMBERS [4]
3-DIGIT DDC CLASS NUMBERS [5]
TO LIST OF TOPICS OR LIST OF PERSPECTIVES
FOR LIST OF TOPICS
DDC CLASS NUMBERS
CHOOSE SHORTEST DDC CLASS NUMBER [6.a]
SHORTEST DDC CLASS NUMBER [6.b]
SAME AS CALL NUMBER SEARCH (FIGURE 39)
FOR LIST OF PERSPECTIVES
3-DIGIT DDC CLASS NUMBERS
FIRST NUMBER [7.a]
LAST NUMBER [7.a]
DDC CLASS NUMBER INDEX [7.b]
DDC CLASS NUMBER INDEX [7.b]
TOPIC RECORD NUMBER
TOPIC RECORD NUMBER
TOPIC FILE [7.c]
TOPIC FILE [7.c]
DDC CAPTION (LINE A)
DDC CAPTION (LAST LINE)
LIST OF PERSPECTIVES

Fig. 40. Subject outline search in DOC

4. Groups these DDC class numbers in such a way that all DDC class numbers starting with the same three digits belong to one group. (Each such group represents a Perspective.)

5. If there is exactly one group in step 4, displays the List of Topics (step 6). Otherwise, displays the List of Perspectives (step 7).

6. Displays the List of Topics by

    a. Choosing the shortest DDC class number in the group (i.e., one that represents the most general subject).
    b. Using the DDC class number obtained in step 6.a and following the procedure for DOC's call number search (section 5.5.2.3).

7. Displays the List of Perspectives by
   a. Getting a three-digit DDC class number from step 4.
   b. Using the DDC class number obtained in step 7.a to get the topic record number from the DDC class number index.
   c. Using the topic record from step 7.b to get the DDC caption from the topic file and displaying it in the PERSPECTIVE column of the List of Perspectives.
   d. Repeating steps 7.a-7.c until all three-digit DDC class numbers obtained in step 4 have been processed.

5.5.2.5 Display of Bibliographic Records

The display of bibliographic records can be performed after a set of bibliographic record numbers has been saved as the result of a direct search or after the selection of line(s) from the List of Aspects in the alphabetical search or the List of Topics in the call number or subject outline search. The display of bibliographic records is shown in fig. 36 and explained in section 5.5.1.4.

5.6 Ongoing Review of SOC and DOC

Throughout the twenty months of the DDC Online Project, the DDC Online Project team consistently obtained comments from representatives of the four participating libraries, Decimal Classification Division (DCD) staff, Forest Press staff, and project consultants regarding types of indexes, fields for indexing and display, and the overall process of searching the experimental online catalog. At the first meeting of project participants held at the Library of Congress, it was determined that a prototype of the experimental online catalog accessible by dial-up terminals would provide all project participants with an opportunity to advise the DDC Online Project team about indexing, display, and the search process.

The prototype was designed, developed, tested, and implemented in spring 1984 on the OCLC Sigma CP-V mainframe computer using APL programming language. In May 1984, representatives of participating libraries, Decimal Classification Division staff of LC, and project consultants were informed of the prototype through a lengthy sample search, and of the protocol for signing onto CP-V and APL using dial-up terminals through lengthy instructions. Some participants studied the sample searches and accessed the online prototype; others only studied the sample searches. OCLC's Interim Report to CLR dated September 1984 contained examples of the search "Ball Games" in the prototype online catalog without the DDC as a user's tool and with the DDC as a user's tool, respectively (Markey 1984).

We received many responses to the APL prototype, particularly from project consultants and participants from the Library of Congress, which helped us to examine decisions about indexing, display, and the search process. Consultant Lois Chan visited OCLC in April 1984 to get a first-hand look at the DDC Online Project team's design of the experimental online catalogs and to advise the team about indexing and displaying bibliographic records and searching the catalogs. Consultant Pauline Cochrane responded to printouts of searches of the APL prototype in a lengthy written response. The DDC Online Project team compiled a list of critical design issues and travelled to the Library of Congress in June 1984 to discuss these issues with Mrs. Cochrane and to resolve them.

In late August 1984, development of the experimental online catalog on the LSI-11 microcomputer had reached the point where it was feasible to obtain a printout of SOC and DOC searches using a test database of about two-hundred items. This printout, which showed subject searches in SOC (see appendix A of the OCLC Interim Report to CLR dated February 1985) and DOC (see appendix B of the OCLC Interim Report to CLR dated February 1985) (Markey and Demeyer 1985), was sent to project participants at the four participating libraries, the Decimal Classification Division, Forest Press, and project consultants and was distributed to interested OCLC staff. Review comments were solicited from all participants.

Review comments were collected, analyzed, and summarized into the four functional areas of online catalogs (see appendix G). The comments are listed in appendix G alongside the action taken to alter the systems in view of the review comments. When it was difficult for the DDC Online Project team to make a decision about a design issue, project consultants and Decimal Classification Division staff were consulted. In sections 5.6.1-5.6.4, we review the actions taken to all review comments but highlight the important ones that were expressed later by library patrons and staff in online retrieval tests.

5.6.1 Operational Capabilities

One review comment stressed the need for a command-driven interface in addition to the experimental online catalog's menu-driven interface. When designing the experimental online catalog, we wanted first-time users of the system to be able to search SOC and DOC with ease and find items relevant to their expressed topic, since most of the searchers in the retrieval tests would be using the experimental online catalog for the first time. Thus, we instituted a menu-based interface into the experimental online catalog because we felt that this interface was more appropriate than a command-based interface for first-time users of this system.

One reviewer identified the need for a capability to go from the DDC Schedules back to the DDC Relative Index. Since the four databases created for the four participating libraries were restricted to one or two subject areas, there were a few Relative Index entries bearing a common main Relative Index entry and one or two secondary entries. Thus, DOC searchers usually needed to browse the alphabetically arranged Relative Index entries once to find a relevant entry to display bibliographic records or to be directed to the appropriate place in the DDC Schedules. When the entire Relative Index is available in an online catalog, the ability to maneuver from the Relative Index to the Schedules and back to the Relative Index will be necessary.

5.6.2 Searching Capabilities

Reviewers urged us to implement Boolean operators into the experimental online catalog. Originally, these Boolean operators were in the design of the search process (see fig. 4) and developed and tested in the experimental online catalog. The Boolean operators were deleted because of a lack of coding space in the LSI-11 microprocessor. In a discussion of the SOC and DOC searching process in sections 5.2 and 5.3, we pointed out that the major difference between the initial design of the search process (fig. 4) and the actual design of the SOC and DOC search processes (figures 12 and 19, respectively) was the omission of Boolean operators as a means of refining or limiting the ongoing search. Library patrons and staff participating in the online retrieval tests also expressed the need for Boolean operators for refining the results of the ongoing search (see sections 8.4.7 and 8.7.3).

5.6.3 Display and Output Capabilities

One of the most difficult decisions facing the project team was the redundancy and a possibly misleading characteristic of Relative Index entries displayed in bibliographic records. Initially, terms added to bibliographic records from the Relative Index were processed into a field entitled "Dewey Index" and displayed in bibliographic records. However, such added information became redundant in bibliographic records when displayed as a result of DOC subject searches. Plus, a Relative Index entry describes the subject matter of books classed in the area, but that Relative Index entry and others bearing the same DDC number do not necessarily describe all of the subject matter contained in a book classed in that area. Thus, Relative Index entries listed in bibliographic records might mislead searchers by indicating that a retrieved item contains information described by the entry. In fact, Relative Index entries often represent the class to which the subject matter of the book belongs, rather than the precise content of the book.

Advice from consultants and Decimal Classification Division staff helped the DDC Online Project team to decide to suppress the display of Relative Index entries in bibliographic records. A number of alternatives were proposed, such as displaying Relative Index entries before bibliographic records are displayed by the user and providing users with an option at the end of each display of a bibliographic record to display Relative Index entries. Memory limitations of the hardware used in the DDC Online Project made it impossible to implement such alternatives in this study; however, such alternatives are also recommendations for future implementations of the DDC and library classifications, in general, as users' tools for subject access, browsing, and display in online catalogs.

Another review comment stressed the need for suppressing the display of Schedule information where this display contained no additional information to the DDC number and Schedule caption. One suggestion supplied by reviewers was to append valid option codes to aspects and topics to help searchers determine the appropriate next step in the ongoing search. The operation of appending valid option codes to aspects and topics could be done when aspects and topics are first processed into their respective DOC index. For example, each topic in a List of Topics would be accompanied by valid option codes for browsing more general topics (BG), browsing more specific topics (BS), or displaying Schedule notes and Relative Index entries (GN):

```
GENERAL TOPIC : 795 Games of chance
    LINE  ITEMS  LOCATION         TOPIC
      A     13   795.0            General aspects (BS, BG)
      B     28   795.1            Backgammon, craps, other games with dice (BG,
                                  GN)
      C      4   795.2            Roulette and other wheel and top games (BG,
                                  GN)
      D     14   795.3            Games dependent on drawing numbers or
                                  counters (BG, GN)
      E    222   795.4            Card games (BS, BG, GN)
```

One reviewer commented that the hyphens in the DDC Relative Index looked unnatural. At the initial meeting of project participants in January 1984, the group assembled decided to use Relative Index entries in the subject areas selected by the four participating libraries and experiment with the display of Relative Index entries in the APL prototype (see section 3.2). In the prototype, the alphabetical search featured a display of Relative Index entries in which the indention of entries in the printed Relative Index was replaced by two hyphens between main and secondary Relative Index entries. This process of inserting hyphens could be done automatically and the results would be satisfactory when the hyphens separated main and secondary entries or two secondary entries that expressed two different concepts. However, the results of this process were not satisfactory when the hyphens separated main and secondary entries or two secondary entries that made sense as a phrase. Manual editing is necessary to distinguish between the two instances. In the DOC Online Project, we instituted the process of automatically inserting hyphens even though the results were not always satisfactory. In retrospect, we should have separated main and secondary entries and two secondary entries with a colon (:) because insertion of a colon is standard practice in chain indexing. Both Relative Index entries and chain index strings begin with specific terms and proceed toward broad terms. Also, the editors of the DDC could consider manual editing of DDC Relative Index entries to ensure that phrases are not separated into two or more fields of Relative Index entries. Then, the automatic insertion of hyphens or colons between main and secondary entries or two secondary entries would not look unnatural.

The experimental online catalog featured only one display format for bibliographic records, i.e., the full format with all fields and their contents displayed, because we wanted retrieval test participants to see one and only one representation of bibliographic records upon which to base their relevance assessments. Even though one reviewer's comment stressed the need for a short display format, we did not implement the short format because of our objective in the retrieval tests. In the online retrieval tests, library staff and patrons also called for more than one display format (see section 8.7.4).

In the experimental online catalog, searchers must first enter a valid option code followed by other information as necessary. Reviewers found themselves reversing the order of entering options and line letters. For example, they first entered a line letter and expected SOC or DOC to know which option they were thinking about that worked in conjunction with the line letter. As system designers, we felt that this operation was generally inconsistent with the entry of options into the experimental online catalog. When a line letter preceded the entry of an option code, the catalog responded with an error message to enforce the correct entry of option codes and other information.

If we redesigned the experimental online catalog for additional experiments, we could allow users to enter a line letter and have SOC or DOC respond with a list of options that were valid to select along with the line letter. For example, entering a line letter after the display of Relative Index entries in an alphabetical search would trigger a list of options that were valid to select along with the line letter, i.e., SL (select lines to display items), or ST (search subject outline for a listed topic) (see also section 8.7.4).

5.6.4 User Assistance

Nearly half the reviewers' comments covered the user assistance capabilities of SOC and DOC. We were able to change a number of user assistance capabilities based on reviewer comments, and we feel that the experimental online catalog that was installed at the University of Illinois, i.e., the first installation of the catalog at a participating library, benefited from reviewer comments. The online searching process was streamlined by eliminating redundant or cumbersome tasks (e.g., pressing RETURN after completing the display of bibliographic records) and the wording used in directive and suggestive prompts, explanatory messages, option names and descriptions, or online lists of controlled vocabulary was improved. During the installation of the experimental online catalog at the University of Illinois, we collected more comments from library staff and patrons in retrieval tests, especially about the wording in prompts, messages, option names and descriptions, or online term lists, and made additional changes to the SOC and DOC interfaces for the experimental online catalogs installed in and tested at LC, NYSL, and PLCFC.

The most difficult option names to express in option codes and explain in a few words in option descriptions were the four subject searching options, i.e., alphabetical, direct, call number, and subject outline searches. After a number of tries, we finally chose option names and descriptions that stuck, so to speak, throughout the four installations at the participating libraries. In online retrieval tests, we found that users had difficulty at first determining which subject search option to select and what the subject search would do to their entered term or call number. Searchers later expressed in post-search interviews that they needed to use each subject searching option to find out what it did (see section 8.7.1).

5.6.5 Enhancements to SOC and DOC Based on Retrieval Tests at the University of Illinois

The experimental online catalogs were pretested with a handful of library patrons and staff at OCLC in late October 1984 and with fifteen library staff and thirteen patrons at the University of Illinois. The DDC Online Project team gained considerable experience performing online searches in the experimental catalogs when preparing for the OCLC and Illinois pretests and testing the final versions of the catalogs for installation at Illinois. Based on the pretests and the team's searching experience, the following enhancements were added to the experimental online catalog for installation at the three remaining libraries (Library of Congress, New York State Library, and Public Library of Columbus and Franklin County):

1. Searching Capabilities. If there was only one perspective in DOC as the result of a user-entered term in an SS (search subject outline for subject) search, DOC responded immediately with the specific List of Topics.
   Reason: Library staff, in particular, were baffled by the terminology "perspectives" only when the user-entered access point directed them to one perspective. Many restarted the search rather than follow through the course of the search and select the BP (browse a perspective) option to display the specific List of Topics.

2. Searching Capabilities. Terms from the first-listed subject heading (6XX) field of bibliographic records were added to the keyword indexes for the SS option in DOC, thus providing searchers with additional subject access points in the indexes with which to match their entered terms.
   Reason: We wanted to include the first-listed subject heading in the DOC index for the subject outline search at UI. But, there was not enough time available to reindex and test the DOC system for the University of Illinois and keep to our data collection schedule. DOC indexes for the subject outline search at LC, NYSL, and PLCFC contained the first-listed subject heading.

3. Searching Capabilities. Terms from the general note (not) field of the DDC Schedule were added to the keyword indexes for the subject outline (SS) option in DOC, thus providing searchers with additional subject access points in the indexes with which to match their entered terms, and general notes were displayed in DDC Schedule note records.
   Reason: The general note field usually contained a scope note and could have helped some users in subject retrieval. (See also 5 below)

4. Searching Capabilities. The entire DDC number (i.e., not a DDC number truncated according to the DDC Schedules) was indexed in the call number (SC) search option in SOC. The postings still included all bibliographic records whose DDC class numbers started with the given DDC number.
   Reason: SOC developed for the University of Illinois only indexed class numbers that were listed in the 19th edition of DDC, and users entered class numbers that were not listed in the 19th edition but displayed in retrieved bibliographic records.

5. Display Capabilities. DDC Relative Index entries and general note fields were added to the display of DDC Schedule notes triggered by the GN (get detailed notes for a topic) option.
   Reason: Library patrons and staff were disappointed in the displays triggered by the GN option and wanted more information, especially scope notes, in these displays.

6. User Assistance Capabilities. Explanations about the lists of subject terms resulting from alphabetical search (SA) option in SOC and DOC and subject outline search (SS) option in DOC were added in one or two lines of text preceding the List of Aspects or List of Topics. Text

that preceded the alphabetical List of Aspects when the user-entered term was not listed: "CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER. IF YOUR SUBJECT IS NOT LISTED, TRY ANOTHER SEARCH OPTION." Text that preceded the List of Topics was "ITEMS ON YOUR SUBJECT ARE FOUND UNDER XXX.XXX IN THIS OUTLINE OF RELATED SUBJECTS."
Reason: Some library patrons did not know how these lists of terms could possibly help them find library material on a topic. The messages hinted to patrons how to use such term lists in the course of their search.

7. User Assistance Capabilities. Explanations about DDC Schedule note records were added to DOC in one or two lines of text preceding the display of selected fields. Text that preceded this display "Notes from items on this TOPIC are found at the designated shelf LOCATION. DEWEY INDEX describes the contents of most items found at this shelf LOCATION.
   Reason: Library patrons expressed certain expectations about these records (which no library patron had ever seen before in the traditional library catalog or online catalog). For example, they expected these records to give the definition of the DDC caption. An explanatory message with these records hinted to online searchers how to use such records in the course of their search.

8. User Assistance Capabilities. The line in the alphabetical search (SA) options in SOC and DOC that read "**Your subject was not found. Please try another search option:**" was deleted.
   Reason: Users whose entered terms almost matched a listed term found this message confusing because a listed term was often so close to their term (minus punctuation, plural or singular endings, -ing or -ed endings, etc.). The addition of the messages preceding Topic and Aspects Lists (see 6 above) should have helped users determine how to use these lists.

9. User Assistance Capabilities. The description of the BF (browse forward) and BB (browse backward) options in the alphabetical search was enhanced to include the phrase "in this alphabetical list."
   Reason: Some library patrons did not know how the Lists of Aspects was arranged. With the addition of the phrase, we hoped that patrons would understand that the List of Aspects was arranged in alphabetical order.

5.7 Summary

The functionality and operation of the experimental online catalog were featured in chapter 5. In sections 5.2 and 5.3, a nontechnical discussion of the functionality of SOC and DOC was provided which included examples of the three different subject search options in SOC and the four different subject search options in DOC for the same topic.

The internal organizational structure of SOC and DOC was described in section 5.4. This discussion showed that SOC and DOC were actually one system in which selected index fields and bibliographic files were shared. This sharing of data eliminated redundant information in the database and, thus, reduced the required storage area. We needed both SOC and DOC to conduct retrieval experiments with library patrons and staff. In a production environment, two systems would not be needed. Thus, the organizational structure of an online catalog in which the DDC has been implemented as a searcher's tool for subject access, browsing, and display would not altogether resemble the organizational structure of the experimental online catalog used in this project.

The operation of SOC and DOC subject searches and displays was provided in section 5.5. Each search or display capability was described in a step-by-step fashion and accompanied by a figure to diagram the search process.

The DDC Online Project team did not design the experimental online catalog's capabilities and interface alone. Throughout the design, development, and pretest phases of the catalog, the team sought the expertise of the representatives from the four participating libraries, Decimal Classification Division staff, Forest Press, project consultants, and interested OCLC staff to refine the search process, improve the contents of searchable indexes, and assist in the development of the experimental online catalog's interface. Review comments from these sources were obtained in response to subject searches in a test database of about 200 items from the University of Illinois. The comments were analyzed and summarized into the four functional areas of online catalogs, and the DDC Online Project team took action to alter the experimental online catalog in view of the review comments. A pretest at OCLC and the University of Illinois also resulted in changes to the system with regard to its searching, display, and user assistance capabilities. After the pretest at the University of Illinois in November 1984, the experimental online catalog's capabilities and interface were frozen and no additional changes were made.

6. Methods Used to Conduct the Online Retrieval Tests

6.1 Introduction

The experimental online catalog developed for the DDC Online Project was actually composed of two online catalogs: (1) DOC, or Dewey Online Catalog, in which the DDC had been implemented as an online searcher's tool for subject access, browsing, and display; and (2) SOC, or Subject Online Catalog, in which the DDC had not been implemented. These systems were purposely designed to be very much alike to focus the attention of library patrons and staff on the DDC enhancement in retrieval tests. DOC and SOC had virtually the same interfaces, and they accessed the same bibliographic items. Except for DOC's enhancement by the DDC, the two systems and their capabilities were the same.

In online retrieval tests, library staff and patrons performed online subject searches in both DOC and SOC. They were asked questions that prompted them to make comparisons between the two systems with respect to the systems' subject searching capabilities and performance. Thus, the retrieval tests yielded quantitative data about the systems' capabilities used and items retrieved in the searches and qualitative data about searchers' experiences using the systems' searching capabilities. The quantitative and qualitative data go hand-in-hand; that is, results of the retrieval tests are expressed by both the quantitative and qualitative data analyses.

In this chapter, the experimental design of the Comparison Search Experiment (sections 6.2 and 6.3) and Sample Search Experiment (sections 6.2 and 6.4) are described. The data collection procedures and instruments used in the two retrieval experiments are highlighted. The quantitative and qualitative data analyses that were applied to the data collected in retrieval experiments are also covered.

6.2 Design of the Online Retrieval Tests

In the DDC Online Project, two retrieval tests were conducted using the methodology employed by Siegel et al. (1983) in their evaluation of two prototype online catalogs at the National Library of Medicine. These two retrieval tests were (1) a partially controlled but authentic Comparison Search Experiment in which library patrons at the four participating libraries conducted online searches on a topic of their own choosing--sequentially--on SOC and DOC, judged the relevance of retrieved items, and answered open-ended questions about their searching experiences with SOC and DOC; and (2) a controlled field experiment, the Sample Search Experiment, in which library staff volunteered and performed equivalent--but different--searches in SOC and DOC, simulating the representative subject searching strategies in an online catalog. The Sample Search Experiment controlled for two important variables--professional role/occupation and a potentially confounding "transfer effect" stemming from the same person conducting a search for the same topic on SOC and DOC--while the Comparison Search Experiment did not. In the Comparison Search Experiment, library patrons performed online searches for a topic of their own choosing in SOC and DOC. The searching scenario was much more realistic than the Sample Search Experiment, since it featured library patrons with an expressed need for information.

Underlying our approach to testing the experimental online catalog was the research strategy adopted from the Siegel et al. study (1983) to distribute equitably and realistically the response burden among participating libraries' patrons and staff and weave across the two study methods a common thread of similarly worded questions relating to a core set of dependent and independent variables (i.e., measures defining the nature and ease of SOC and DOC use, and user attributes thought to be potentially related to search satisfaction and system preference). These variables were assigned in an overlapping fashion across the two methods to ensure a high degree of confidence in the strength and reliability of retrieval test results obtained under different experimental conditions (including different user populations). Dependent and independent variables are listed in table 10.

Table 10. Dependent and Independent Variables Measured in the Sample Search and Comparison Search Experiments

Variables	Sample Search Experiment	Comparison Search Experiment
Dependent Variables		
Number of retrieved items	X	X
Number of relevant items retrieved	X	X
Number of nonrelevant items retrieved	X	X
Time spent searching SOC and DOC	X	X
Ease of system and system capability use	X	X
Satisfaction with the subject searches	X	X
System preference	X	X
Independent Variables		
Type of user (patron or staff)	X	X
Interface (with/without DDC online)	X	X
First system searched by the user	X	X
Subject area (per library)	X	X
Topic searched	X	

6.3 Comparison Search Experiment (Patrons)

6.3.1 Data Collection Procedures and Instruments

The Comparison Search Experiment was more realistic than the Sample Search Experiment because library patrons were searching SOC and DOC with their own search topics and assessing the relevance of retrieved items. In this experiment, forty patrons at each of the four participating libraries were asked to conduct a self-initiated search of their own choosing on both SOC and DOC, sequentially. Patrons entering the area where the LSI-11 equipment was located were recruited for the experiment. Patron refusals were recorded on a tally sheet (see appendix H). When recruited, patrons were told that they would receive a reward for their participation in the retrieval test. (Each library gave a different reward: five dollars by the University of Illinois, library tote bag or mug by the Public Library of Columbus and Franklin County, library notepad or letter opener by the Library of Congress, and New York State regents tumbler or Capitol Story book by the New York State Library.)

Each participant was randomly assigned to one of two odd/even experimental conditions. Odd-numbered participants first searched SOC, and even-numbered participants first searched DOC. The interviewer, one member of the same two-person team conducting the Sample Search Experiment, briefly explained the experiment to the patron and asked the patron to complete some demographic questions. Then, the patron began searching SOC or DOC for a topic of his own choosing. The interviewer closely monitored the participant's searches and recorded them on hardcopy printouts for subsequent analysis for relevance. If the patron did not stop searching on his own, the interviewers determined when it was appropriate for the participant to stop, switch systems, and repeat the search for the same search topic in the other system. In the retrieval tests, most patrons stopped searching on their own or looked around for the data collector to tell them what to do next. After the participant completed online searches for the same search topic in both systems, the interviewer asked the participant to review the hardcopy printouts (in the same order in which the searches were performed, i.e., SOC first, then DOC, or vice versa), and mark each item printed with an R for relevant, a P for possibly relevant, or an N for not relevant to the participant's search topic. Then, the interviewer asked the participant questions about his experiences searching the two systems. Appendix I is the questionnaire completed by the interviewer throughout the Comparison Search Experiment. At each participating library, 40 searchers performed a total of 40 searches in SOC and 40 searches in DOC for 40 different expressed topics. A grand total of 320 searches were performed in the Comparison Search Experiment. Patrons' expressed search topics are listed in appendix L for the four participating libraries.

The procedures used in the Comparison Search Experiment are the following:

1. Source of search topic: Library Patron
2. Online searcher in DOC: Library Patron
3. Online searcher of the same query in SOC: Library Patron who executes a SOC search for this query
4. Source of relevance assessments: Library Patron

5. Interviewer: One member of two-person data collection team

6. Estimated completion time: 35-45 minutes

6.3.2 Quantitative Data Analysis

In the Comparison Search Experiment, the two systems (SOC and DOC) were studied at the four participating libraries. The system that was first searched by the patron was varied so that approximately half of the recruited patrons first searched SOC and the other half first searched DOC. Time spent searching, estimated recall, and precision[1] were dependent, and quantitative measures were collected in each SOC and DOC search.

Table 11 shows the structure of the data analyzed in the Comparison Search Experiment. In this table, each observation (X i, j, k, l) corresponds to a single search on which the three dependent measures were collected. Index i designates one of the four libraries, index j indicates which system was searched first, k is the patron number, and l is the system that was searched. In the table, the fourth index, l, takes on a value of one when SOC is searched, and a 2 when DOC is searched.

There were twenty patrons within every cell created by crossing "library" with "first system searched" (n = 20), and a total of 160 (abn = 4 x 2 x 20) patrons. At the first library when the experimental online catalog was installed and tested (University of Illinois) patrons 1 to n first searched the SOC system while patrons n+1 to 2n first searched the DOC system. This pattern was repeated with patrons 2n+1 to abn at the other three institutions.

Actually, the number of patrons within each library x first system searched condition was not always the same (i.e., equal to twenty). When recruiting patrons for the Comparison Search Experiment, patrons identified a subject search that turned out to be a known-item search or a subject search outside the subject coverage of the experimental online catalog's database. In the analysis, we discarded such searches and recruited another patron to replace the discarded searches. Newly recruited patrons were assigned the next one of two odd/even experimental conditions (for beginning their search on SOC or DOC) without regard to the odd/even experimental condition of the discarded searches.

At two libraries, nineteen patrons first searched SOC while twenty-one first searched DOC. At the other two libraries, the pattern was reversed. This resulted in unequal sample sizes within cells. The SAS (Statistical Analysis System) statistical procedure called General Linear Models (GLM) was used because it performs an analysis for situations with unequal sample sizes within cells (Freund and Littell 1981, 91-94).

Table 11. Structure of Quantitative Data Analyzed in the Comparison Search Experiment

Library	First System Searched	Patron	System:	
			SOC	DOC
1	1	1	$X_{1,1,1,1}$	$X_{1,1,1,2}$
	.	.	.	.
	.	.	.	.
	1	n	$X_{1,1,n,1}$	$X_{1,1,n,2}$
	2	n+1	$X_{1,2,n+1,1}$	$X_{1,2,n+1,2}$
	.	.	.	.
	.	.	.	.
	2	2n	$X_{1,2,2n,1}$	$X_{1,2,2n,2}$
.				
.				
i	j	k	$X_{i,j,k,1}$	$X_{i,j,k,2}$
.				
.				
a	2	160	$X_{a,2,abn,1}$	$X_{a,2,abn,2}$

a = number of libraries (4)
b = number of systems that could be searched first (2)
n = number of patrons within each library x first system searched cell (20)

Since the difference between SOC and DOC systems, or the "system effect," was of primary interest, we could have analyzed the data by comparing the means of the dependent measures for the two systems using a t-test. This analysis would have been simple because it ignores any effects due to "libraries" and "first system searched." If we had felt that the "library" and "first system searched" would have had no effect on time spent searching, recall, and precision, the t-test would have been an appropriate statistical procedure. But we felt that "library" and "first system searched" could have had an impact on the dependent measures. For example, it was likely that patrons would have been slower on

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[1] Estimated recall and precision are defined in sections 7.4.1 and 7.5.1.

their first search and faster on their second due to practice and familiarity with the system. Such an effect could have increased the variability in the dependent measures and obscured the "system effect" that was of primary interest. General Linear Models (GLM) is a statistical procedure that is used to remove or to partition the variation due to "institution" and "first system" factors. By removing these sources of variance, GLM techniques provided a test of the difference between SOC and DOC that was more sensitive than an overall t-test.

Another source of variation that was removed by GLM was differences among patrons. Some patrons were faster or slower in their searches than other patrons. Some patrons also differed in the degree of their relevance assessments. For example, one patron was very particular and designated very few items relevant while another designated almost every retrieved item as relevant. Therefore, differences among the individual patrons could have had a large effect on the dependent measures. In the Comparison Search Experiment, the same patron performed a search for the same topic in SOC and DOC. Differences in search times between the two systems for a given patron were not affected by whether one patron tended to be faster or slower than another patron. The only sources of the differences between the two measures were a systematic difference between the two systems and measurement error (including variability within the individual). Each patron served as his own control in the statistical comparison of SOC and DOC. Removing the effects due to differences among individual patrons from the test of differences of the two systems greatly improved the ability to detect an effect of SOC or DOC.

In the terms of GLM, the patrons were nested within the "library" and "first system searched" factors because each patron belonged to only one library and only searched one of the two catalogs first. The system factor was a repeated measure within each patron. Equivalently, "library" and "first system searched" were referred to as "between" patron factors while the system factor was "within" the patron. The design of the analysis was thus a two-between and one-within design. This design provided a very powerful test of the system effect and also allowed the influence of "library" and "first system searched" to be assessed as well. A schematic outline of the sources of variation within the design is shown in fig. 41.

The between patrons' error was a component of the between patrons' variation and was used to test the between patrons' effects, i.e., library, first system searched, and the interaction of the library and first system searched effects. The within patrons' error was used to test the within patrons' effects, i.e., system (SOC or DOC), the interaction of the library and system, the interaction of the first system searched and system, and the interaction of the library and first system searched and system effects.

```
                         Total Variation

                        df = abcn-1
                         /         \
                        /           \
                       /             \
                      /               \
                     /                 \
   Between Patrons                           Within Patron
     Variation                                 Variation

      df = abn-1                                       df = abn(c-1)
      / |  | \                          / |     | \     \
     /  |  |  \                        /  |     |  \     \
    /   |First  Library x        System  Library x | First   Library x First
 Library|System  First System   (SOC or DOC) System  | System  System Searched
        |Searched Searched                          |Searched   x System
        |                                           |x System
  df = a-1|df = b-1  df =               df = c-1   df =       |  df =    df =
        |         (a-1) (b-1)         (a-1) (c-1)| (b-1)x   (a-1)x
        |                                        | (c-1)    (b-1)x
        |                                        |          (c-1)
        |                                        |
   Between patrons' error          Within patrons' error
      df = ab(n-1)                            df = ab(c-1) (n-1)
```

a = number of libraries (4)
n = number of patrons in each library x first system searched cell (20) (Comparison Search Experiment)
n = mean number of library staff within each library x first system searched cell (7.5) (Sample Search Experiment)
b = number of systems which could be searched first (2)
c = number of systems (2)
x denotes an interaction between two effects
df = degrees of freedom

Fig. 41. Sources of variation in the comparison search and sample search experiments

A two-between and one-within GLM was conducted for each of the three dependent measures (time spent searching, recall, and precision). Estimated recall and precision are proportions. This presented a problem using GLM, since the variability of sample proportions depends on the value of the proportion in the population. This means that the equal variance assumption of GLM may be violated. Taking the square root of scores, however, reduces differences in the variance between groups of scores. To avoid the problem of unequal variances, the square root of recall and precision were actually analyzed using GLM.

6.3.3 Qualitative Data Analysis

Library patrons were asked six open-ended questions about their subject searching experiences in SOC and DOC after they had performed subject searches in both systems on a topic of their own choosing (see appendix I):

1. Tell me any specific difficulties you had using the first computer catalog.
2. Tell me any specific difficulties you had using the second computer catalog.
3. What differences between the two online catalogs did you notice?
4. How did these differences help (or hinder) you to carry out the online search?
5. What capability of the first catalog you used was most helpful for directing you to information relevant to your topic?
6. What capability of the second catalog you used was most helpful for directing you to information relevant to your topic?

The answers to these questions were not always on the tip of the patron's tongue and had to be drawn out through the interviewer's probing. This probing helped to focus the patron's attention on a specific SOC or DOC capability or display and to elicit their kudos about the system(s) as a whole or specific system capabilities and their suggestions for improving SOC and DOC. (Probes are listed in open-ended questions in the questionnaire in appendix I.) In two separate questions, patrons were asked to choose which system was more satisfactory for their subject searches and which system they would want to use the next time they had to conduct a computer catalog search. Participants were asked to state their reasons for choosing SOC or DOC or neither system.

Patrons' responses to open-ended questions were grouped into emerging themes. An analysis of these themes and patrons' remarks resulted in a descriptive framework of eight themes: (1) patrons' difficulties using SOC or DOC or both systems, (2) good points of SOC, (3) good points of DOC, (4) differences between SOC and DOC, (5) SOC capabilities directing the patron to relevant items, (6) DOC capabilities directing the patron to relevant items, (7) reasons for the patrons' satisfaction with the search, and (8) reasons for the patrons' preference for SOC or DOC. An outline of these eight themes and subtopics under each theme are listed in table 12. Responses categorized into subtopics were not always elicited from patrons at all four participating libraries; libraries in which there were no patron responses about a subtopic are marked accordingly in table 12.

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Table 12. Outline of Themes in the Comparison Search Experiment

1. Patrons' difficulties using SOC or DOC or both systems
    - a) Output difficulties
    - b) Limit difficulties
    - c) Online messages
    - d) System friendliness
    - e) Users' expectations (except LC)
    - f) Users' familiarity with the system (except NYSL, UI)
    - g) Entry of access points (except NYSL)
    - h) SOC's subject search options
        - (1) SA (alphabetical search) option
        - (2) SD (direct search) option (except NYSL, PLCFC, UI)
        - (3) SC (call number search) option (except NYSL, UI)
    - i) DOC's subject search options
        - (1) SA (alphabetical search) option
        - (2) SS (subject outline search) option
        - (3) GN (get detailed notes for a topic) option (except PLCFC)
    - j) Other search functions

2. Good points of SOC
    - a) System friendliness
    - b) Online messages (except NYSL, PLCFC)
    - c) Output (except LC, UI)
    - d) SOC's subject search options
        - (1) SA (alphabetical search) option
        - (2) SD (direct search) option (except LC, NYSL, PLCFC)
    - e) User's familiarity with the systems (except LC, NYSL)

3. Good points of DOC
    - a) System friendliness (except PLCFC)
    - b) DOC's subject search options
        - (1) SA (alphabetical search) option (except LC, NYSL, UI)
        - (2) SS (subject outline search) option
        - (3) SC (call number search) option (except NYSL, PLCFC)
    - c) Users' familiarity with the systems (except LC, NYSL)

4. Differences between SOC and DOC
    - a) Relating to options
    - b) Relating to bibliographic records (except UI)
    - c) Relating to output
    - d) Relating to time spent searching
    - e) DOC's subject search options
        - (1) SA (alphabetical search) option
        - (2) SS (subject outline search) option
        - (3) SC (call number search) option (except NYSL, PLCFC)
    - f) SOC subject search options
        - (1) SA (alphabetical search) option (except LC, NYSL)

5. SOC capabilities directing the patron to relevant items

6. DOC capabilities directing the patron to relevant items

Table 12. Outline of Themes in the Comparison Search Experiment (continued)

7. Reasons for the patrons' satisfaction with the search
   a) In SOC
   b) In DOC
   c) In both (or neither) system(s)

8. Reasons for the patrons' preference for
   a) SOC
   b) DOC
   c) Both (or neither) system(s)

6.4 Sample Search Experiment (Staff)

6.4.1 Data Collection Procedures and Instruments

In this experiment, fifteen library staff (composed of librarians and nonlibrarians uninvolved in the design and development of SOC and DOC or the library's automated system, and who were not experts in searching or frequent searchers of commercial retrieval systems, such as BRS or Lockheed's DIALOG) were recruited by the participating library liaison to the DDC Online Project and scheduled to take part in the Sample Search Experiment by the library liaison. Prior to the scheduled time, we encouraged the searcher to use DOC and SOC at least once to become familiar with the use of the experimental online catalog. If the searcher had not used SOC and DOC by the scheduled time of the experiment, the interviewer allowed the searcher to use SOC or DOC for ten to fifteen minutes prior to the retrieval test.

The fifteen searchers were randomly assigned to one of two experimental conditions (DOC/SOC) when scheduled for individual search sessions. Each searcher received three paired search queries simulating representative search strategies for subject searching in an online catalog, and executed the three paired search queries in SOC and DOC (i.e., a total of six different queries). The search queries were paired by type of search strategy required for obtaining successful search results using the subject search options in the experimental online catalog and its browsing features. No one searcher ever executed a search for the same query on both SOC and DOC; instead, the search queries were matched. This matching should have reduced the carry-over effect of the searcher's performing consecutive searches on two different systems.

The queries for subject searches were selected from a pool of topics collected from patron reference requests by the participating library liaison and a pool of topics suggested to the DDC Online Project team by subject specialists. Each query underwent thorough pretesting by the DDC Online Project team to determine the type of search strategy that the query required to produce successful results and that would have best suited the execution of the query given the searching capabilities allowed by DOC and SOC. The team then paired each query with another like it. A searcher received one set of paired search queries at a time and executed searches on SOC and DOC. (See appendix J for the worksheet, on which paired search topics are listed for, presented to, and completed by the library staff respondent.) The matching of searches controlled for differences in search type. The same searcher performing the same types of searches on both systems equalized the impact of his searching skills, knowledge, and experience in the analysis.

Upon completion of each search pair, the interviewer asked the library staff member about his experiences searching SOC and DOC using open-ended questions. Appendix K is the questionnaire completed by the interviewer throughout the Sample Search Experiment. The respondent then checkmarked the hardcopy printouts for relevant items retrieved (in the order in which the paired search queries were executed in DOC and SOC). The searcher had three options: (1) relevant, (2) possibly relevant, and (3) not relevant. When the searcher completed online searches for all three paired queries, he was asked by the interviewer some general open-ended questions about his online searching experiences in SOC and DOC. At each participating library, 15 searchers performed a total of 45 searches in SOC and 45 searches in DOC for 45 different topics. A grand total of 360 searches were performed in the Sample Search Experiment. Assigned search topics for which staff at the four participating libraries performed online searches are listed in appendix L.

The procedures used in the Comparison Search Experiment are the following:

1. Source of search topic: Subject experts and participating libraries
2. Determination of search strategy for a query: DDC Online Project team member(s) who are expert online searchers
3. Online searcher in SOC: Library staff member
4. Online searcher of the same query in DOC: Library staff member who is different from one who executes a SOC search for this query
5. Source of relevance assessments: Library staff member who executes the search
6. Interviewer: One member of two-person data collection team
7. Expected completion time for searches and interview: 120 minutes

6.4.2 Quantitative Data Analysis

In the Sample Search Experiment, the two systems SOC and DOC were studied at four libraries. At each library, fifteen library staff volunteered to perform a total of six subject searches for six different topics. Each staff member performed these six searches by alternating between SOC and DOC until three searches had been performed for different topics on each of the two systems.

The system that was first searched by the library staff member was varied so that approximately half of the staff first searched SOC and the other half first searched DOC. Time spent searching, estimated recall,[1] and precision[1] were dependent and quantitative measures collected in each SOC and DOC search.

Table 13 shows the structure of the data analyzed in the Sample Search Experiment. The structure of the staff data is similar to the structure of the patron data (see section 6.3.2). In table 13, each observation (X i, j, k, l) corresponds to a single search on which the three dependent measures were collected. Index i designates one of the four libraries, index j indicates which system was searched first, k is the staff member number, and l is the system that was searched. In the table, the fourth index, l, takes on a value of one when SOC is searched and two when DOC is searched.

The design of the analysis for the staff data was the same as the two-between and one-within design used in the Comparison Search Experiment with patrons (see fig. 41). There was an odd-numbered group of staff (15) taking part in the Sample Search Experiment, which was divided into two groups, one of which began searching in SOC, and the other in DOC. Thus, there was an unequal number of staff members in each library x first system searched cell (7.5). Therefore, GLM was used here, too, since it performs an analysis for situations with unequal sample sizes within cells. We used the GLM for the statistical analysis of the Sample Search Experiment for the same reason we used this analysis in the Comparison Search Experiment: to be able to reveal the primary effect (system effect) and secondary effects (library and first system searched). (See section 6.3.2.) In fig. 41, the sources of variance for the GLM in the Comparison Search Experiment are identified.

A two-between and one-within GLM was conducted for each of the three dependent measures (time spent searching, recall, and precision). Recall and precision are proportions. As stated above in the discussion on the Comparison Search Experiment, this presented a problem using GLM, since the variability of sample proportions depends on the value of the proportion in the population. This means that the equal variance of GLM may be violated. Taking the square root of the scores, however, reduces differences in the variance between groups of scores. To avoid the problem of unequal variances, the square root of recall and precision were actually analyzed using GLM.

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[1] Estimated recall and precision are defined in sections 7.4.1 and 7.5.1.

Table 13. Structure of Quantitative Data Analyzed in the Sample Search Experiment

Library	First System Searched	Staff Member	System: SOC	DOC	. .	SOC	DOC
1	1	1	$X_{1,1,1,1}$	$X_{1,1,1,2}$	. .	$X_{1,1,1,5}$	$X_{1,1,1,6}$
	.	.	.	.			. .
	.	.	.	.		.	.
	1	8	$X_{1,1,8,1}$	$X_{1,1,8,2}$	. .	$X_{1,1,8,5}$	$X_{1,1,8,6}$
	2	9	$X_{1,2,9,1}$	$X_{1,2,9,2}$	. .	$X_{1,2,9,5}$	$X_{1,2,9,6}$
	.	.	.	.		.	.
	.	.	.	.		.	.
	2	15	$X_{1,2,15,1}$	$X_{1,2,15,2}$	. .	$X_{1,2,15,5}$	$X_{1,2,15,6}$
.							
.							
i	j	k	$X_{i,j,k,1}$	$X_{i,j,k,2}$	. .	$X_{i,j,k,5}$	$X_{i,j,k,6}$
.							
.							
a	2	60	$X_{a,2,abn,1}$	$X_{a,2,abn,2}$	. .	$X_{a,2,abn,5}$	$X_{a,2,abn,6}$

a = number of libraries (4)
b = number of systems that could be searched first (2)
n = mean number of library staff within each library x first system searched cell (7.5)

6.4.3 Qualitative Data Analysis

Library staff were asked eight open-ended questions about their subject searching experiences in SOC and DOC after they had completed each pair of subject searches in both systems for two different topics (see appendix K):

1. Tell me any specific difficulties you had using the online catalog to perform the first search listed.
2. Tell me what you would like to help you improve the first online catalog search.
3. What capability (or function) of the first catalog you used was most helpful for directing you to information relevant to the topic?
4. Tell me any specific difficulties you had using the online catalog to perform the second search listed.
5. Tell me what you would like to help you improve the second online catalog search.
6. What capability (or function) of the second catalog you used was most helpful for directing you to information relevant to the topic?
7. What differences between the two online catalogs did you notice?
8. How did these differences help you (or hinder you) to carry out the online search?

After performing subject searches for each pair of searches, library staff were asked to choose which system was most satisfactory for their subject searches. They were also asked their reasons for choosing SOC or DOC or neither system. When library staff had completed online subject searches for the three pairs of searches in SOC and DOC, they were asked which system they preferred and why they preferred the system they had selected. They were also asked two more open-ended questions to obtain additional information on their searching experiences in SOC and DOC.

1. Think about the searches that you performed in SOC. What features, capabilities, and aspects of SOC were particularly desirable? Undesirable? Suggestions to improve the system?
2. Think about the searches that you performed in DOC. What features, capabilities, and aspects of DOC were particularly desirable? Undesirable? Suggestions to improve the system?

The answers to all these questions were not always on the tip of the staff member's tongue and had to be drawn out through the interviewer's probes. These probes helped to focus staff members' attention on a specific SOC or DOC capability or display and to elicit their kudos about the system(s) as a whole or specific system capabilities and their suggestions for improving SOC or DOC. (Probes are listed in open-ended questions in the questionnaire in appendix K.)

Library staff responses to open-ended questions were grouped into emerging themes. An analysis of these themes and staff remarks resulted in the same descriptive framework of eight themes constructed in the analysis of patrons' remarks in the Comparison Search Experiment: (1) staffs' difficulties using SOC or DOC or both systems, (2) good points of SOC, (3) good points of DOC, (4) differences between SOC and DOC, (5) SOC capabilities directing staff to relevant items, (6) DOC capabilities directing staff to relevant items,

(7) reasons for staffs' satisfaction with the search, and (8) reasons for staffs' preference for SOC or DOC. An outline of these eight themes and subtopics under each theme are listed in table 14. Responses categorized into subtopics were not always elicited from staff at all four participating libraries; libraries in which there were no staff responses about a subtopic are marked accordingly in table 14.

Table 14. Outline of Themes in the Sample Search Experiment

1. Staff members' difficulties using SOC or DOC or both systems
    a) Output difficulties
    b) Limit difficulties
    c) Online messages
    d) System friendliness
    e) Users' expectations (except LC)
    f) Users' familiarity with the systems
    g) Entry of access points
    h) Need for cross-references and related terms
    i) SOC's subject search options
        (1) SA (alphabetical search) option (except UI)
        (2) SC (call number search) option (except PLCFC, UI)
    j) DOC's subject search options
        (1) SA (alphabetical search) option (except UI)
        (2) SS (subject outline search) option
        (3) ST (subject outline search from a topic in List of Aspects) option (except LC, PLCFC, UI)
        (4) BP (browse perspectives) option (except PLCFC, UI)
        (5) SC (call number search) option (except LC)
    k) Other search functions

2. Good points of SOC
    a) System friendliness (except NYSL, PLCFC)
    b) Online messages (except NYSL)
    c) Output (except PLCFC, UI)
    d) SOC's subject search options
        (1) SA (alphabetical search) option (except NYSL)
        (2) SD (direct search) option

3. Good points of DOC
    a) DOC's subject search options
        (1) SA (alphabetical search) option (except NYSL, PLCFC)
        (2) SS (subject outline search) option
        (3) SD (direct search) option (except UI)
        (4) SC (call number search) option (except NYSL)

Table 14. Outline of Themes in the Sample Search Experiment (continued)

4. Differences between SOC and DOC
    a) Relating to options
    b) Relating to bibliographic records (except LC)
    c) Relating to output
    d) Relating to time spent searching (except PLCFC)
    e) DOC's subject search options
        (1) SA (alphabetical search) option (except LC, NYSL)
        (2) SS (subject outline search) option
        (3) SC (call number search) option
    f) SOC's subject search options
        (1) SA (alphabetical search) option (except LC, PLCFC, UI)

5. SOC capabilities directing the staff to relevant items

6. DOC capabilities directing the staff to relevant items

7. Reasons for the staffs' satisfaction with the search
    a) In SOC
    b) In DOC
    c) In both (or neither) system(s)

8. Reasons for the staffs' preference for
    a) SOC
    b) DOC
    c) Both (or neither) system(s)

6.5 Summary

In the DDC Online Project, two retrieval tests were conducted with the four participating libraries' patrons and staff: (1) a partially controlled but authentic Comparison Search Experiment in which library patrons conducted online searches on a topic of their own choosing--sequentially--on SOC and DOC, and (2) a controlled field experiment, the Sample Search Experiment, in which library staff performed equivalent but different subject searches in SOC and DOC, simulating the representative subject searching strategies in an online catalog. Two retrieval experiments were employed to test the experimental online catalog to ensure a high degree of confidence and strength in the results of the experiments that were obtained under different experimental conditions with different user populations.

The Comparison Search and Sample Search Experiments yielded quantitative measures, such as time spent searching, recall, and precision, and qualitative data about the subject searching experiences of library patrons and staff. The methods of analysis featured in this chapter were a preparation for the data, analyses, and results of the retrieval tests in chapters 7 and 8 of this report.

7. Time Spent Searching, Estimated Recall, Precision, and Matched Output in Online Retrieval Tests

7.1 Introduction

This chapter describes the quantitative analysis of online retrieval test data. To help explain the quantitative analysis, we have included patron and staff remarks made in post-search interviews. This chapter begins with a discussion of online retrieval test participants' prior experience with online catalogs (section 7.2). Their responses to demographic questions in the presearch interview shed light on the purpose of patrons' searches in the experimental online catalog, the frequency of online catalog use and familiarity with the subjects searched by patrons and staff, and staff use of computers other than the online catalog and their library responsibilities.

Section 7.3 features an analysis of the time spent searching the experimental online catalog, the relationships of time spent searching and the satisfaction of patrons and staff with the search, and time spent searching and their system preference. Section 7.4 features an analysis of estimated recall in experimental online catalog searches and the relationship of estimated recall, and the satisfaction of patrons and staff with the search and estimated recall and their system preference. The percentage of matched relevant items retrieved and displayed in SOC and DOC searches is also provided in section 7.4. Section 7.5 repeats the discussion of section 7.4, but highlights precision in the experimental online catalog and the relationships of precision to search satisfaction and system preference. The percentage of matched items retrieved and displayed in SOC and DOC searches is also covered in section 7.5.

Recall and precision are traditional measures for evaluating the searching performance of online retrieval systems. The discussions defining recall and precision point out serious drawbacks that make them unreliable performance measures. In this study, we used these measures to identify differences between the searching performance of SOC and DOC. Our quantitative analysis demonstrated differences between SOC and DOC with respect to the time spent searching, recall, and precision; however, the statistics in the quantitative analysis only tell us that there are differences between SOC and DOC. A failure analysis of the individual subject searching options is necessary to identify the reasons for the differences. This failure analysis provided in the next chapter is the first step toward improving the systems and their capabilities.

From the results of the quantitative analysis, we identified differences between SOC and DOC. We did not employ these results to compare the two systems and to determine the better system. Rather, we used the quantitative analysis constructively to find differences between the two systems, analyze these differences, and suggest ways of improving the systems to provide better performance.

7.2 Searchers' Prior Experience with Online Catalogs

7.2.1 Library Patrons in the Comparison Search Experiment

Generally, library patrons at the four participating libraries were recruited by one of the two interviewers in the two-member data collection team. In a five-day-long pretest of the Comparison Search Experiment in the Mathematics Library of the University of Illinois, the interviewers were only able to recruit fourteen library patrons. We discussed our recruiting difficulties with library staff in the Mathematics Library and decided to offer participants a five-dollar reward for taking part in the Comparison Search Experiment. After we placed posters in the Mathematics Library and in the hallways of the Mathematics Building announcing the Comparison Search Experiment and five-dollar reward, we had no difficulties recruiting library patrons for the experiment.

Patrons were recruited when they walked up to the experimental online catalog, interviewers, or the circulation desk to inquire about the experiment. Over four days and three evenings (November 26-29, 1984), we recruited forty library patrons and turned away one whose topic of interest was outside the subject coverage of the experimental online catalog's database. Three patrons refused to take part because they could not spare the necessary thirty to forty-five minutes for the experiment.

Rather than giving a monetary incentive to patrons at the Public Library of Columbus and Franklin County, we gave participants the choice of a library mug or totebag. Posters announcing the experiment were placed at the entrances to the Main Library building and Humanities Reference Department. To obtain the quota of forty library patrons, the interviewers recruited during every daytime and evening hour that the Main Library was open from Monday, March 19, to Saturday, March 24. We recruited patrons when they walked up to either the experimental online catalog or an interviewer to inquire about participation in the experiment, and we actively recruited patrons who were browsing in the stacks or reading at desks. Nineteen patrons refused to take part because they had no time and two patrons were turned away because their topics of interest were outside the scope of the experimental online catalog's database.

Comparison Search Experiment participants at the Library of Congress were given the choice of a Library of Congress notepad or letter opener. Posters announcing the experiment were placed at the entrance to the Social Science Reading Room and near the fifth-floor elevators used by patrons to get to the Reading Rooms. To obtain the quota of forty library patrons, the interviewers recruited during every daytime and evening hour that the Social Science Reading Room was open and the interviewers were not conducting the Sample Search Experiment with library staff--from Monday, April 22, to Saturday, April 27, and from Monday, April 29, to Thursday, May 2. Patrons were recruited when they walked up to the experimental online catalog or interviewers to inquire about the experiment. Over the ten days and seven evenings of recruiting forty library patrons, thirty-one patrons refused to take part because they had no time and eight patrons' topics of interest were outside the scope of the experimental online catalog's database.

At the New York State Library, Comparison Search Experiment participants were given a New York State Regents tumbler or a book on the history of the New York State capitol. NYSL staff recruited library patrons for inclusion in the

Comparison Search Experiment by making an appointment with their regular patrons or by asking library patrons reading or researching in the library to take part in the experiment. We still placed posters in high-use areas of the library to announce the experiment and obtain the participation of library patrons.

When library patrons were recruited for the Comparison Search Experiment, we did not know until they had performed their online searches in SOC and DOC that their topics of interest were outside the scope of the experimental online catalog's database. Thus, we recruited more than forty library patrons at LC, PLCFC, and NYSL for the Comparison Search Experiment and discarded two searches at PLCFC, one search at LC, and three searches at NYSL when we realized that the topics of these searches were outside the experimental online catalog's subject coverage.

In the Comparison Search Experiment, library patrons were asked to perform online searches in SOC and DOC for a topic of their own choosing. In table 15, the purposes of searchers' experimental online catalog searches are listed. It is not surprising that the largest proportion of searchers at all four libraries were performing a search of personal interest because of the special recruiting situation of the Comparison Search Experiment. That is, patrons might not have had an urgent need to search the library catalog for material on a topic of interest at the time of the Comparison Search Experiment, but were willing to perform online searches for a topic of personal interest as a favor to the library or library staff, obtain the reward, pass a few minutes of free time, or some other reason. The largest group of patrons performing searches for class- or course-related purposes was found at the only academic library in the DDC Online Project--the University of Illinois Mathematics Library--where most of the participants were undergraduate students. At the Public Library of Columbus and Franklin County, few patrons performed a search for a purpose other than personal interest. At the New York State Library, most participants were researching their or another's genealogy and regarded this as a search for personal interest. Searchers at the Library of Congress expressed a variety of purposes for their online search; at LC we obtained the largest percentage of searchers whose search purpose was for research. In a related study of online catalog use at the Library of Congress, comparable proportions for search purpose were reported (Anderson et al. 1982) so that the special situation created by the Comparison Search Experiment did not bias the recruitment of searchers at LC.

The frequency of patrons' use of the participating library's online catalog is listed in table 16 for the three libraries--LC, NYSL, and UI--where there was an online catalog available for patron use. PLCFC featured an online catalog for staff but not patron use. The percentages of first-time users and users who accessed the online catalog a few times a year were surprisingly high at the University of Illinois in view of the frequency of online catalog use at academic institutions in a related study in which academic library users accessed the online catalog on a weekly basis (Markey 1983a, 56-57). However, most UI participants were undergraduate students in mathematics who relied on textbooks. At NYSL, a large proportion of searchers had never used the library's online catalog. NYSL reference staff reminded us that the genealogical researchers who participated in the online retrieval tests consulted a surname index file and vital records file and alphabetical list of NYS counties with their respective class numbers rather than the online catalog. At LC, nearly two-thirds of the searchers in the Comparison Search Experiment were daily or weekly users of the library's online catalog. These searchers represented the largest group of frequent online catalog users from among the four participating libraries. These proportions are comparable to those obtained in a related study of online catalog use at LC (Anderson et al. 1982, fig. 2). PLCFC did not offer online catalog searching to patrons. Thus, the majority of Comparison Search Experiment participants were not frequent online catalog users, and many had never before used an online catalog. Based on our familiarity with the frequency of online catalog use at university, public, and state and federal libraries (Markey 1983a, 55-57), we feel that the participants in the Comparison Search Experiment searched the library's online catalog less frequently than did participants in related research into online catalog use at these three types of libraries; however, this infrequency of online catalog use was associated with the classification areas selected by the library for study in this project, especially at NYSL and UI.

Table 15. Purpose of Patrons' Search

	Library				
The purpose of your online catalog search is for:	LC %Patrons	NYSL %Patrons	PLCFC %Patrons	UI %Patrons	Total %Patrons
Class- or course-related purposes	15	0	5	40	15
Personal interest	35	80	88	55	65
Advanced research	28	5	0	5	9
Job purposes	22	15	7	0	11
Number of cases =	40	40	40	40	160

Table 16. Frequency of Online Catalog Use by Patrons and Staff

Do you use the library's computer catalog:	LC		NYSL		PLCFC	UI		Total	
	%Patrons	%Staff	%Patrons	%Staff	%Staff	%Patrons	%Staff	%Patrons	%Staff
Daily	23	80	5	53	47	10	53	13	58
Weekly	40	13	22	13	40	22	13	28	20
Monthly	5	7	15	20	7	18	7	13	10
A few times a year	17	0	28	7	6	30	27	25	10
Never before	15	0	30	7	0	20	0	21	2
Number of cases =	40	15	40	15	15	40	15	120	60

Before performing an online search, patrons rated their familiarity with their topic of interest. The majority of patrons at the three participating libraries who were asked about their familiarity with their topic of interest felt that they were very familiar or somewhat familiar with their topic of interest (table 17).

Table 17. Patron and Staff Familiarity with Subjects Searched

Familiarity with subject searched today (patrons) or subject of catalog's database (staff):	LC		NYSL		PLCFC		TOTAL	
	%Patrons	%Staff	%Patrons	%Staff	%Patrons	%Staff	%Patrons	%Staff
Very familiar	35	40	22	7	42	20	33	22
Somewhat familiar	53	40	48	67	43	60	48	56
Somewhat unfamiliar	2	20	20	13	10	20	11	18
Very unfamiliar	10	0	10	13	5	0	8	4
Number of cases =	40	15	40	15	40	15	120	45

Note: Patrons and staff at UI were not asked this question.

7.2.2 Library Staff in the Sample Search Experiment

Library staff at all four participating libraries who took part in the Sample Search Experiment were recruited by library staff members at the participating libraries who served as liaisons between the data collection team and the participating library. Participating library staff were scheduled for a two-hour time period during the second week of a two-week visit by the data collection team at UI, PLCFC, and NYSL or over the two weeks during which the data collection team visited LC. Library staff participants in the Sample Search Experiment did not receive rewards like Comparison Search Experiment participants.

The majority of library staff used their library's online catalog on a daily or weekly basis (table 16). Except at LC, library staff were daily or weekly users of computers other than the libraries' computer catalog(s) (table 18). Library staff in the Sample Search Experiment probably had more experience using the computer catalog and computers in general than patrons in the Comparison Search Experiment. The majority of library staff were familiar with subject areas in which they conducted subject searches (table 17).

The responsibilities of participating library staff differed from library to library (table 19). Overall, a quarter of the library staff in the Sample Search Experiment regularly performed reference duties and another quarter regularly performed technical services duties.

Table 18. Staff Use of Computers Other Than the Online Catalog

How often do you use computers other than library's computer catalog?	LC %Staff	NYSL %Staff	PLCFC %Staff	UI %Staff	Total %Staff
Daily	13	47	87	53	50
Weekly	20	13	7	13	13
Monthly	13	13	0	7	8
A few times a year	27	7	6	27	17
Never before	27	20	0	0	12
Number of cases =	15	15	15	15	60

Table 19. Staff Library Responsibilities

My library responsibilities are best described as:	LC %Staff	NYSL %Staff	PLCFC %Staff	UI %Staff	Total %Staff
Administration	0	20	40	13	18
Reference	40	27	13	27	27
Technical Services	27	33	13	40	28
Clerk/tech assistant	13	7	27	0	12
Other	20	13	7	20	15
Number of cases =	15	15	15	15	60

7.3 Time Spent Searching the Experimental Online Catalog

7.3.1 Library Patrons in the Comparison Search Experiment

A total of 160 different library patrons searched the experimental online catalog at the four participating libraries. All but 10 (6%) library patrons in the Comparison Search Experiment were searching SOC and DOC for the first time.

The results of the statistical test called the General Linear Models (GLM) are shown in table 20 for a comparison of the amount of time spent searching SOC and DOC. GLM was used in this analysis of the time spent searching to ferret out effects, such as library and first system searched, that we felt might have an impact on the results (see also section 6.3.2). GLM identifies the sources of variance that have a significant effect but not how the sources of variance affect the time spent searching. To find out how the sources of variance affected the time spent searching, we have to rely on descriptive statistics, other statistical tests, and patrons' interview remarks.

The results of the GLM in table 20 contain three significant effects. The first and most important effect is the system effect (F = 21.44, p < .0001), which indicates that the time spent searching the two systems SOC and DOC was different. To find out just how different the time spent searching them was, patrons' average time spent searching SOC and DOC is shown in table 21. The average search took 11.5 minutes in SOC and 13.6 minutes in DOC. At all four libraries, the average amount of time spent searching DOC exceeded the average amount of time spent searching SOC. In a statistical test comparing the means (or averages) of the amount of time spent searching SOC and DOC, the amount of time spent by patrons searching DOC at UI was significantly longer than the amount of time spent by patrons searching SOC for the same topic of interest. While patrons spent more time searching DOC than SOC at LC, NYSL, and PLCFC, the amount of time searching DOC was not significantly longer at these three libraries.

Table 20. GLM for Time Spent Searching by Patrons

Source of Variance:	df	SS	MSS	F	Pr > F
Total	319	10897.8			
Library	3	435.1	145.0	3.69	0.0134
First system searched	1	12.3	12.3	0.31	0.5762
Library X First system searched	3	21.6	7.2	0.18	0.9059
Between patron error	152	5980.8	39.3		
System (SOC or DOC)	1	388.6	388.6	21.44	0.0001
Library X System	3	14.8	4.9	0.27	0.8464
First system searched X System	1	1271.4	1271.4	70.14	0.0001
Library X First system searched X System	3	40.4	13.5	0.74	0.5312
Within patron error	152	2755.4	18.1		

The second significant effect (table 20) is the library effect (F = 3.69, p < .0134). This means that the average time spent searching SOC and DOC was not the same at all four libraries. At LC, the average amount of time spent searching SOC exceeded the average amount of time spent searching DOC at the three other participating libraries. Furthermore, the amount of time spent searching DOC at LC took nearly a minute and a half longer than the time spent searching SOC at LC. We were not surprised by such lengthy searches at LC because of our experience in a related study of online catalog use (Anderson et al. 1982), in which the interviewers distributing self-administered questionnaires noted that they often waited a long time, e.g., a half hour to an hour, to give a questionnaire to an online searcher of the MUMS and/or SCORPIO systems.

Table 21. Average Times Spent Searching by Patrons

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
Average time spent searching	13.8	15.2	11.1	12.9	10.9	13.5	10.2^a	12.7^a	11.5^b	13.6^b
• In n of 40 searches, the average time spent searching SOC exceeded time spent searching DOC	16		17		14		10		57 (36%)	
• In n of 40 searches, the average time spent searching DOC exceeded time spent searching SOC	22		23		24		27		96 (60%)	
• In n of 40 searches, the average time spent searching SOC equaled time spent searching DOC	2		0		2		3		7 (4%)	
Number of cases =	40		40		40		40		160 (100%)	

[a] Differences between the two means for SOC and DOC were significant ($t = 2.37$, $p < .03$).
[b] Significant system effect was obtained (see table 20).

The third significant effect (table 20) is the interaction between the first system searched by the patron and the system ($F = 70.14$, $p < .0001$). This interaction means that the difference between SOC and DOC, i.e., system effect, depended upon whether patrons were performing their first search in SOC or in DOC. To clarify this interaction, we drew up table 22, which lists the average time spent searching SOC when SOC was the first system searched by the patron (followed by a search for the same topic in DOC) and the average time spent searching DOC when DOC was the first system searched by the patron (followed by a search for the same topic in SOC). At all four libraries, the average time spent searching SOC exceeded the average time spent searching DOC when SOC was the first system searched by the patron; however, the differences in the time spent searching SOC and DOC at each of these four libraries when SOC was the first system searched was not significant. At all four libraries, the average time spent searching DOC exceeded the average time spent searching SOC when DOC was the first system searched by the patron. The differences in the time spent searching SOC and DOC at each of these four libraries when DOC was the first system searched was significant.

Table 22. Average Times Spent Searching in the First System Searched by Patrons

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
Average time spent searching when SOC is the first system searched (followed by a DOC search for the same topic)	15.6	13.7	12.9	10.3	13.2	11.1	11.3	10.7	13.3	11.5
• In n of 20 searches, the average time spent searching SOC exceeded time spent searching DOC	12		15		13		9		49 (60%)	
• In n of 20 searches, the average time spent searching DOC exceeded time spent searching SOC	7		6		6		11		30 (36%)	
• In n of 20 searches, the average time spent searching SOC equaled time spent searching DOC	2		0		1		0		3 (4%)	
Number of cases =	21		21		20		20		82 (100%)	
Average time spent searching when DOC is the first system searched (followed by a SOC search for the same topic)	11.8^a	16.8^a	9.1^a	15.7^a	8.5^a	16^a	9.1^a	14.8^a	9.6^b	15.8^b

Table 22. Average Times Spent Searching in the First System Searched by Patrons (continued)

	LC SOC	LC DOC	NYSL SOC	NYSL DOC	PLCFC SOC	PLCFC DOC	UI SOC	UI DOC	Total (Four Libraries) SOC	Total (Four Libraries) DOC
• In n of 20 searches, the average time spent searching SOC exceeded time spent searching DOC	4		2		1		1		8 (10%)	
• In n of 20 searches, the average time spent searching DOC exceeded time spent searching SOC	15		17		18		16		66 (85%)	
• In n of 20 searches, the average time spent searching SOC equaled time spent searching DOC	0		0		1		3		4 (5%)	
Number of cases =	19		19		20		20		78 (100%)	

[a] Differences between the two means for SOC and DOC were significant ($t = 2.85$, $p < .01$).
[b] Significant system effect was obtained (see table 20).

The experimental online catalog was installed at the four participating libraries for a total of four weeks. The catalog was available for use by library patrons and staff during the first two weeks of installation. During the last two weeks of installation, the Comparison Search and Sample Search Experiments were conducted by the data collection team of the DDC Online Project. Unfortunately, few patrons took advantage of the first two-week installation period to use the experimental online catalog. We discovered this when conducting the Comparison Search Experiment as only ten of the 160 library patrons in the Comparison Search Experiment had used SOC or DOC prior to their searches for the experiment. Many library patrons had never before used the library's online catalog or used it a few times a year (see table 16). We believe that patrons' first searches in SOC or DOC took longer than the subsequent search in the other system because they were using the experimental online catalog for the first time and, thus, just becoming accustomed to its subject searching capabilities and displays, learning how to enter option names and line letters, and finding out what options did. Comments made in interviews conducted after patrons' online searches in SOC and DOC supported this.

- After first searching DOC, SOC was easy to search. (two patrons, LC; one patron, NYSL)
- Once you use DOC (or SOC), using SOC (or DOC) is easier because you've become familiar with the system. (one patron, UI; three patrons, PLCFC)

- The systems are easy to use after you practice a while. (one patron, PLCFC)

DOC featured one more subject searching option and three additional options (associated with browsing subject information in the outlines of DDC Schedule captions) than SOC. These options for searching and display were unique to DOC and had never before been incorporated into any online catalog. Since these options and displays were wholly new to the task of searching the library catalog, patrons were taking time to use these options and to browse displays that they had never before experienced. Patron searchers noticed these different system capabilities and displays and their effect on the time spent conducting the search. Here are a few of their comments:

- You have to enter more options to find what you want in DOC. For example, it took three DOC options to accomplish what two SOC options accomplished. (one patron, UI)

- SOC has fewer options than DOC and is quicker to search. (one patron, LC)

- DOC had a lot of new things to do in catalog searching that I'd never experienced before. (one patron, PLCFC)

In the post-search interviews, a number of patrons expressed satisfaction with the SOC or DOC search because of the short search time in one system or the other.

- SOC was quicker to search than DOC. (four patrons, NYSL; three patrons, UI; four patrons, PLCFC)

- DOC is easier and quicker to use than SOC and retrieved more relevant items on my topic. (three patrons, PLCFC)

- I don't like spending an hour finding a book because I only spend an hour reading it. (one patron, PLCFC)

We compared patrons' answers on satisfaction with the online catalog search to the length of online searches in SOC and DOC. In table 23, the almost equal proportions of searchers reporting satisfaction in SOC and DOC demonstrates that the amount of time patrons spent searching SOC or DOC had little effect on their selection of the system in which the search was more satisfactory.

In the post-search interviews, a number of patrons' reasons for preferring SOC or DOC were related to the short amount of time it had taken to perform a search in one or the other systems.

- SOC directs you to relevant items quickly. (one patron, NYSL; five patrons, LC; four patrons, PLCFC)

- I found relevant items quicker in SOC than in DOC. (four patrons, NYSL)

- DOC is easy to use and quick to search. (one patron, NYSL; one patron, UI; three patrons, PLCFC)

In table 24, the majority of searchers preferred SOC regardless of the length of the online search. Thus, the length of time taken to search SOC or DOC had little effect on both patrons' satisfaction with the online search and their system preference.

Table 23. Patrons' Search Satisfaction and the Time Spent Searching

The online search took a shorter time to complete in:	In relation to what you were looking for, was the search more satisfactory in:		
	%SOC	%DOC	%No Difference
SOC	61	57	62
DOC	35	34	38
No difference	4	9	0
Number of cases =	79	47	34

Table 24. Patrons' System Preference and the Time Spent Searching

The online search took a shorter time to complete in:	The next time you need to conduct a computer catalog search, will you choose:		
	%SOC	%DOC	%No Difference
SOC	65	48	66
DOC	32	42	34
No difference	3	10	0
Number of cases =	75	50	35

7.3.2 Library Staff in the Sample Search Experiment

A total of sixty different library staff searched the experimental online catalog at four participating libraries. For all but ten (17%) library staff in the Sample Search Experiment, library staff were searching SOC and DOC for the first time.

In table 25, the results of the GLM are shown for a comparison of the amount of time spent searching SOC and DOC in the Sample Search Experiment. GLM was used in this analysis of the time spent searching for the same reasons it was used in the Comparison Search Experiment, viz., to identify effects, such as library and first system searched, which we felt might have an impact on the results (see also section 6.4.2). GLM identified the sources of variance that have a significant effect but not how the sources of variance affected the time spent searching. To find out how the sources of variance affected the time spent searching, we have to rely on descriptive statistics, other statistical tests, and patrons' interview remarks.

The results of the GLM in table 25 contain two significant effects. The first and most important effect is the system effect ($F = 11.6$, $p < 0.0013$), which indicates that the time spent searching the two systems SOC and DOC was different. To find out just how different the time spent searching SOC and DOC was, staffs' average times spent searching SOC and DOC are shown in table 26. The average search in SOC took 7.7 minutes and in DOC 9.3 minutes. At all four libraries, the average amount of time spent searching DOC exceeded the average amount of time spent searching SOC. In a statistical test comparing the means (or averages) of the amount of time spent searching SOC and DOC, the amount of time spent by staff searching DOC at LC and NYSL was significantly longer than the amount of time spent by staff searching SOC for the same topic of interest. The amount of time spent by staff searching DOC at PLCFC and UI was longer than the amount of time spent by staff searching SOC, but the amount of time searching DOC was not significantly longer at these two libraries.

Table 25. GLM for Time Spent Searching by Staff

Sources of Variance:	df	SS	MSS	F	Pr > F
Total	359	6348.7			
Library	3	109.9	36.6	1.86	0.1455
First system searched	1	1.1	1.1	0.05	0.8162
Library X First system searched	3	215.4	71.8	3.65	0.0181
Between staff error	52	1021.7	19.6		
System (SOC or DOC)	1	209.4	209.4	11.60	0.0013
Library X System	3	36.6	12.2	0.67	0.5751
First system searched X System	1	3.1	3.1	0.17	0.6816
Library X First system searched X System	3	13.9	4.6	0.26	0.8571
Within staff error	52	939.2	18.1		

Unlike the GLM for the time spent searching by patrons, the GLM for the time spent searching by staff contained no significant effect for the library. The average times spent searching SOC and DOC by LC staff were longer than the average times reported at the three other libraries. However, the differences between these average times at LC and the other three libraries did not exceed 1.5 minutes.

The second significant effect (see table 25) is the interaction between the first library searched by the patrons and the system (F = 3.65, p < .0181). This interaction, which was also found in the analysis of Comparison Search Experiment data, means that the difference between SOC and DOC, i.e., system effect, depended on whether staff were performing their first search in SOC or DOC.

Table 26. Average Times Spent Searching by Staff

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
Average time spent searching	7.9[a]	10.3[a]	7.3[a]	9.1[a]	7	7.8	7.7	8.8	7.7[b]	9.3[b]
• In n of 45 searches, the average time spent searching SOC exceeded time spent searching DOC	10		15		16		12		53 (29%)	
• In n of 45 searches, the average time spent searching DOC exceeded time spent searching SOC	26		23		26		25		100 (56%)	
• In n of 45 searches, the average time spent searching SOC equaled time spent searching DOC	9		7		3		8		27 (15%)	
Number of cases =	45		45		45		45		180 (100%)	

[a] Differences between the two means for SOC and DOC are significant ($t = 2.11$, $p < .04$).
[b] Significant system effect was obtained (see table 25).

To clarify this interaction, we drew up table 27, which lists the average time spent searching SOC when SOC was the first system searched by the staff (followed by a search for a different topic in DOC) and the average time spent searching DOC when DOC was the first system searched by the staff (followed by a search for a different topic in SOC). In the Sample Search Experiment, library staff performed online searches for three pairs of search topics. Thus, staff had one opportunity to search DOC once or SOC once as the first system in the initial pair of searches. After this initial pair of searches, library staff had two more pairs of search topics for which to complete online searches.

In table 27, the average time spent searching SOC when SOC was the first system searched (in the initial pair of searches) exceeded the average time spent searching DOC at LC, PLCFC, and UI; DOC searches by NYSL staff took a mere three-tenths of a minute longer than SOC searches. The average time spent searching DOC when DOC was the first system searched (in the initial pair of searches) exceeded the average time spent searching SOC at three of the four libraries studied. The average time spent searching DOC at UI when DOC was the first system searched equaled the time spent searching SOC. In the second and third pairs of searches conducted by library staff, staff took longer to search DOC than SOC.

Table 27. Average Times Spent Searching in the First System Searched by Staff

	LC SOC	LC DOC	NYSL SOC	NYSL DOC	PLCFC SOC	PLCFC DOC	UI SOC	UI DOC	Total (Four Libraries) SOC	Total (Four Libraries) DOC
1. Average time spent searching when SOC is the first system searched in initial pair (followed by a DOC search for the same topic)	15	13.9	6.8	7.1	8.4	7.9	10.1	9.9	10.1	9.7
• In n of 8 searches, the average time spent searching SOC exceeded time spent searching DOC	4		2		4		3		13 (41%)	
• In n of 8 searches, the average time spent searching DOC exceeded time spent searching SOC	4		4		4		4		16 (50%)	
• In n of 8 searches, the average time spent searching SOC equaled time spent searching DOC	0		2		0		1		3 (9%)	
Number of cases =	8		8		8		8		32 (100%)	

Table 27. Average Times Spent Searching in the First System Searched by Staff (continued)

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
2. Average time spent searching when DOC is the first system searched in initial pair (followed by a SOC search for the same topic)	5.9	12.3	7	10.1	7.7	9.1	8.4	8.4	7.3	10
• In n of 7 searches, the average time spent searching SOC exceeded time spent searching DOC	1		1		3		3		8 (28%)	
• In n of 7 searches, the average time spent searching DOC exceeded time spent searching SOC	5		4		4		2		15 (54%)	
• In n of 7 searches, the average time spent searching SOC equaled time spent searching DOC	1		2		0		2		5 (18%)	
Number of cases =	7		7		7		7		28 (100%)	
3. Average time spent searching when SOC is the first system searched in the second and third pairs	6.3	6.5	7.2	9.3	7.3	7.7	7.3	9	7	8.1
• In n of 15 searches, the average time spent searching SOC exceeded time spent searching DOC	5		6		5		3		19 (32%)	

Table 27. Average Times Spent Searching in the First System Search by Staff (continued)

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
• In n of 15 searches, the average time spent searching DOC exceeded time spent searching SOC	7		6		7		9		29 (48%)	
• In n of 15 searches, the average time spent searching SOC equaled time spent searching DOC	3		3		3		3		12 (20%)	
Number of cases =	15		15		15		15		60 (100%)	
4. Average time spent searching when DOC is the first system searched in the second and third pairs	6.6	11.1	7.7	9.4	5.7	7.1	6.3	8.3	6.6	9
• In n of 15 searches, the average time spent searching SOC exceeded time spent searching DOC	0		6		4		3		13 (22%)	
• In n of 15 searches, the average time spent searching DOC exceeded time spent searching SOC	10		9		11		10		40 (67%)	
• In n of 15 searches, the average time spent searching SOC equaled time spent searching DOC	5		0		0		2		7 (11%)	
Number of cases =	15		15		15		15		60 (100%)	

The results of time spent searching SOC and DOC were similar in the Comparison Search and Sample Search Experiments. Staff searches in DOC took longer than searches in SOC except for searches in which the staff member was searching the experimental online catalog, and SOC, in particular, for the first time (i.e., in the initial pair of searches). Staff members' first searches in the experimental online catalog took longer than the subsequent subject search in the other system because staff were learning how to use the experimental online catalog and becoming accustomed to its subject searching capabilities, alphabetically arranged displays of controlled vocabulary, learning how to enter option names and line letters, and finding out what the options did. Comments in post-search interviews supported this:

- The search took longer in DOC, but I think the search will be faster once I get familiar with DOC. (one staff, UI)
- My confidence increased as I progressed from the first to the third search. (one staff, UI)
- You need practice to enter options, letters, commas, etc. (one staff, NYSL)
- You need more time to orient yourself to DOC searching, especially by call number. My problems could be overcome by more practice searching. (one staff, NYSL)
- I felt more comfortable using DOC after I'd first used SOC. (one staff, LC)
- I first had experiences using DOC, but found items quicker during my second search in SOC. (one staff, UI)

As we mentioned in section 7.3.1, DOC featured one more subject searching option and three additional DOC options (associated with browsing the subject information in the outline of DDC Schedule captions) than SOC. We encouraged staff in the Sample Search Experiment to try all of DOC's subject searching capabilities. Since staff were using DOC's unique subject searching options, browsing its online displays of subject information, and entering its unique options connected with these searching capabilities or displays for the first time, staff were not familiar with DOC's capabilities and this probably lengthened DOC searches. Staff searchers themselves noticed these different system capabilities and their effect on the time spent to conduct the search.

- I didn't have to go through as many steps in SOC as in DOC to get relevant items. (one staff, PLCFC)
- SOC was easier and quicker to search because it had fewer options than DOC. (three staff, LC)
- There were more options in DOC than in SOC, which made it difficult for me to keep track of what was going on. (one staff, UI)

In the post-search interviews, a number of library staff gave reasons for their satisfaction with the SOC or DOC search that were related to the short amount of time it had taken to perform a search in one or the other system.

- I was able to quickly find items in SOC. (five staff, UI; one staff, NYSL; seven staff, PLCFC; two staff, LC)

- There were more options in DOC than in SOC, and DOC took less time to search than SOC. (one staff, UI)

- DOC was quicker than SOC to search. (one staff, NYSL)

In the post-search interviews, only two staff members provided a reason for preferring SOC over DOC because the time spent searching SOC was shorter than the time spent searching DOC. The comparisons of staff responses to the question on satisfaction with the online catalog search to the length of SOC and DOC searches, and to the question on system preference to the length of SOC and DOC searches produced similar results to those obtained in the Comparison Search Experiment and presented in tables 23 and 24. That is, there was no relationship between satisfaction and the length of SOC and DOC searches, and no relationship between system preference and the length of SOC and DOC searches. Thus, the length of SOC and DOC searches did not lead library staff to prefer one system over another.

7.3.3 Discussion of Results for the Time Spent Searching

In general, the time-oriented results for searching SOC and DOC by library patrons and staff in the Comparison Search Experiment and Sample Search Experiment were the same. When the user accessed the experimental online catalog for the first time and searched SOC, the time spent searching SOC exceeded the time spent searching DOC in the next search. The difference in time spent searching SOC and DOC was not significant at any of the four participating libraries when SOC was the first system searched. When the user accessed the experimental online catalog for the first time and searched DOC, the time spent searching DOC exceeded the time spent searching SOC in the search following the user's first search. The difference in time between SOC and DOC searches was significant at all four participating libraries in the Comparison Search Experiment when DOC was the first system searched. We felt that the difference in time between the SOC and DOC systems when one or the other system was accessed first was primarily due to users' learning how to use the system and familiarizing themselves with its subject searching capabilities, alphabetically arranged subject headings and entries, subject outlines, record displays, how to enter options and line letters, and how to best use options to further the ongoing search. In post-search interviews, a number of users noted that the search in the system following their first search was easier than the first search because of their experiences using the first system.

The time spent performing online searches in DOC usually exceeded the time spent performing online searches in SOC. On the average, patrons' DOC searches took 13.6 minutes and their SOC searches took 11.5 minutes. Staff DOC searches averaged 9.3 minutes and their SOC searches averaged 7.7 minutes. The greater length of DOC searches, particularly in the Comparison Search Experiment with patrons, was attributed to DOC's unique subject searching capabilities, unique online displays of subject information, and unique options connected with these searching capabilities or displays. Most patrons in the Comparison Search Experiment encountered these unique capabilities for the first time, especially online displays of the DDC Schedule captions and the options to penetrate deeper or more general levels of the DDC hierarchy. Both patrons and staff recognized that DOC had more options and subject searching capabilities than SOC, and these options and capabilities made DOC searches lengthy at times. In the post-search interviews with library patrons and staff, individuals from both groups noted that their reasons for satisfaction with the search or system preference were connected with the length of time taken to complete the online search. However, a statistical analysis of time spent searching in SOC and DOC and satisfaction with the search or system preference showed that online retrieval test participants did not express satisfaction with the online search in SOC or DOC or did not express a preference for SOC or DOC because of the length of time taken to search SOC or DOC. In fact, the difference in the average length of time taken to search SOC and DOC was between one and two minutes, so it is not surprising that this difference did not make much of an impression on the satisfaction or system preference of online retrieval system participants.

7.4 Estimated Recall in Experimental Online Catalog Searches

7.4.1 Defining Estimated Recall

Recall and precision are performance criteria that are frequently used to evaluate the performance of online retrieval systems and their searching capabilities. Unfortunately, recall and precision are not exact measures because of the subjectivity of relevance assessments, impracticality of scanning an entire collection to find all the relevant items for a given search query, and other reasons specific to experimental conditions.

This section features the estimated recall of experimental online catalog searches; section 7.5 covers the precision of experimental online catalog searches. Recall is defined as "the proportion of all relevant items in a particular collection or database that the search is able to retrieve" (Lancaster 1977, 143). In practice, absolute recall is almost impossible to achieve because the entire collection or database has to be scanned to find all the relevant items for a given query. Even if all the items in a database are scanned to find all the relevant items for a given query, the set of relevant items for a given query reflects the personal and often subjective evaluation of the individual performing the relevance assessment.

In both the Comparison Search and Sample Search Experiments, the online searches of library patrons and staff were recorded from beginning to end of search on a hardcopy printout. Library patrons and staff retrieved items in searches but did not display all items retrieved. Thus, all items retrieved in a search were not recorded on the hardcopy printout. Only items displayed in a search were recorded on the hardcopy printout. Since the items recorded on the hardcopy printout were presented to online retrieval test participants for performing relevance assessments, recall scores in this study were only based on the items retrieved and displayed in online searches, not on the items retrieved on online searches. Furthermore, the time and effort involved in scanning the entire database for every search query to find all relevant items for every query would have been impractical. Thus, we relied on an estimated recall score suggested by Lancaster (1977, 149-50) that combined the relevant items retrieved and displayed in the SOC search for a query and the relevant items retrieved and displayed in the DOC search for the same query.

$$\text{Estimated recall of search a} = \frac{\text{Number of unique relevant items retrieved and displayed in search a}}{\text{Total number of unique relevant items retrieved and displayed in search a and b combined}}$$

Conflicting relevance assessments for the same item retrieved and displayed in both SOC and DOC searches were resolved as follows for identifying relevant items:

1. An item judged relevant by the SOC searcher and possibly relevant by the DOC searcher was deemed relevant.

2. An item judged possibly relevant by the SOC seacher and relevant by the DOC searcher was deemed relevant.

3. An item judged relevant by the SOC searcher and not relevant by the DOC searcher was deemed not relevant.

4. An item judged not relevant by the SOC searcher and relevant by the DOC searcher was deemed not relevant.

In the online retrieval tests, estimated recall scores were affected by the order in which retrieved items were displayed (because the online retrieval test participants displayed only a fraction of the items retrieved). SOC and DOC displayed retrieved items in shelflist order. In the analysis of retrieval test results, we will see how this order affects the estimated recall of online searches (see section 8.3.6).

Retrieval test participants also judged the relevance of references (with subject information) to library material, not the actual full text of a book or document. Their relevance assessment could have been much different if they had based their relevance assessment on the full text of a book or document.

For the reasons described above, recall can be an unreliable criterion for measuring the performance of an online system. At best, recall is an indicator of problem areas in a retrieval system's capabilities that need attention through improvement, redesign, or enhancement. In our analysis of recall of experimental online catalog searches, we used estimated recall scores to identify problems and inadequacies of the capabilities of SOC or DOC. We did not use estimated recall scores to compare SOC and DOC and determine the better of the two systems.

7.4.2 Estimated Recall in the Comparison Search Experiment

In table 28, the results of a GLM are shown for a comparison of estimated recall in SOC and DOC in the Comparison Search Experiment. The GLM was used in this analysis of estimated recall to identify effects, such as library and first-system searching, which we felt might have an impact on the results (see also section 6.3.2). The results of the GLM in table 28 contain one significant effect--the system effect ($F = 10.92$, $p < .0012$)--which indicates that estimated recall scores in SOC and DOC are different. To find out just how different estimated recall was, average estimated recall scores in SOC and DOC are shown in table 29. At three of the four participating libraries, average estimated recall scores in SOC exceeded average estimated recall scores in DOC, and the differences between the two scores was significant. At UI, the estimated recall score in SOC equaled the estimated recall score in DOC. Estimated recall scores in SOC ranged from a low of 58% at UI to a high of 75% at NYSL. Estimated recall scores in DOC ranged from a low of 44% at PLCFC to a high of 58% at UI. The highest estimated recall score in DOC (58%) equaled the lowest estimated recall score in SOC (both at the University of Illinois).

Table 28. GLM for Estimated Recall in Patrons' Searches

Source of Variance:	df	SS	MSS	F	Pr > F
Total	319	3722.8			
Library	3	27.7	9.2	0.82	0.4852
First system searched	1	2.7	2.7	0.24	0.6266
Library X First system searched	3	50.6	16.9	1.50	0.2143
Between patron error	152	1705.3	11.2		
System (SOC or DOC)	1	122.2	122.2	10.92	0.0012
Library X System	3	57.6	19.1	1.72	0.1645
First system searched X System	1	9.0	9.0	0.81	0.3702
Library X First system searched X System	3	43.8	14.6	1.30	0.2748
Within patron error	152	1700.9	11.2		

In table 30, the percentages of matched relevant items, i.e., items retrieved and displayed in both SOC and DOC searches, are shown. Overall, two of every three relevant items retrieved and displayed in a DOC search were unique and were not retrieved and displayed in a SOC search for the same topic. Though DOC's estimated recall was lower than SOC's estimated recall, searchers were likely to retrieve and display a large proportion of relevant items that were unique to the output of each system in online searches for the same topic in SOC and DOC. The number of items judged relevant in a search in one system and possibly relevant in a search in the other system was small. There were five items judged relevant in a search in one system and nonrelevant in a search in the other system even though the same person conducted the same two searches (table 30, 5). Thus, there were few conflicting relevance assessments in the Comparison Search Experiment.

Table 29. Average Estimated Recall Scores in Patrons' Searches

	LC SOC	LC DOC	NYSL SOC	NYSL DOC	PLCFC SOC	PLCFC DOC	UI SOC	UI DOC	Total (Four Libraries) SOC	Total (Four Libraries) DOC
1. Estimated recall	68%[a]	46%[a]	75%[a]	48%[a]	72%[a]	44%[a]	58%	58%	69%[b]	48%[b]
a. In n of 40 searches, SOC estimated recall exceeded DOC estimated recall	19		20		23		17		79 (49%)	
b. In n of 40 searches, DOC estimated recall exceeded SOC estimated recall	11		9		10		12		42 (26%)	
c. In n of 40 searches, SOC and DOC estimated recall were equal	10		11		7		11		39 (25%)	
Number of cases =	40		40		40		40		160 (100%)	
2. Combined total number of relevant items retrieved and displayed	269		254		349		219		1091	
3. Number of relevant items retrieved and displayed	183	123	190	122	251	153	128	127	752	525

[a] Differences between the two means for SOC and DOC were significant ($z \geq 5.05$, $p < .001$).
[b] Significant system effect was obtained (see table 28).

Table 30. Matched Relevant Items in Patrons' Searches

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
1. Percentage of matched relevant items retrieved and displayed in 40 SOC and 40 DOC searches	22%	33%	31%	48%	22%	36%	27%	27%	25%	36%
2. Number of matched relevant items retrieved and displayed in 40 SOC and 40 DOC searches	40		58		55		34		187	
3. Number of relevant items retrieved and displayed in 40 SOC and 40 DOC searches	183	123	190	122	251	153	128	127	752	525
4. Number of matched items in #2 above judged relevant in SOC output and possibly relevant in DOC output, or vice versa (i.e., conflicting relevance assessments considered relevant in this analysis)	4		3		10		5		22	
5. Number of matched items judged relevant and nonrelevant in SOC and DOC output (i.e., conflicting relevance assessments considered nonrelevant in this analysis)	0		1		0		4		5	

In the Comparison Search Experiment, patrons were asked in the post-search interview this question about search satisfaction: In relation to what you were looking for, would you say your search was more satisfactory using SOC, DOC, or was there no difference between the two systems? We compared patrons' responses to this question to the system that attained the higher estimated recall score in an online search for a given topic. The results of this comparison are shown in table 31. The results show that the majority of patrons expressed satisfaction with the search in the system yielding higher estimated recall.

In the post-search interview, patrons were asked a question about the amount of relevant items retrieved and displayed in their SOC and DOC searches for the same topic. Their responses to this question corresponded to the tallies of the system that achieved the higher estimated recall score in an online search for a given topic used to make the comparison in table 31. Thus, comparisons of patrons' responses to this post-search interview question and the question on search satisfaction served as a cross-check on the results of the comparison in table 31. The results are presented in table 32. When patrons retrieved a greater amount of useful information in a system, they tended to be more satisfied with the search in that system than the system that retrieved a lesser amount of useful information.

Table 31. Patrons' Search Satisfaction and Estimated Recall

Greater estimated recall was attained for a given search topic in:	In relation to what you were looking for, was the search more satisfactory in:		
	%SOC	%DOC	%No Difference
SOC	70	28	32
DOC	11	57	18
No difference	19	15	50
Number of cases =	79	47	34

Note: Chi square = 50.01, $p < .001$

Table 32. Patrons' Search Satisfaction and Comparison of the Amount of Useful Information Retrieved

Comparing SOC and DOC, I retrieved:	In relation to what you were looking for, was the search more satisfactory in: %SOC	%DOC	%No Difference
A greater amount of useful information in SOC than in DOC	74	9	22
About the same amount of useful information in both SOC and DOC	19	27	66
A lesser amount of useful information in SOC than in DOC	7	64	12
Number of cases[a] =	77	45	32

Note: Chi square = 88.71, $p < .001$

[a] The six searches in which patrons responded in categories other than those listed on the left were not included in this comparison.

In post-search interviews, patrons gave their reasons for choosing DOC as the system in which the search results were more satisfactory. Their reasons were sometimes based on the number of relevant items retrieved in a DOC search for a given topic:

- DOC generated more relevant items on my topic than SOC. (five patrons, LC)
- DOC is easier and quicker to use than SOC and retrieved more relevant items on my topic. (three patrons, PLCFC)
- DOC retrieved more relevant items than SOC. (four patrons, UI)

Patrons also gave their reasons for choosing SOC as the system in which the search results were more satisfactory based on the number of relevant items retrieved in a SOC search for a given topic.

- I found more relevant items in SOC than in DOC. (five patrons, LC; one patron, NYSL; two patrons, PLCFC; three patrons, UI)

Patrons were mixed in their decision to choose SOC or DOC when both systems performed equally well (or badly) returning relevant items.

- I obtained many of the same items in SOC and DOC. (four patrons, LC; two patrons, NYSL; one patron, PLCFC; four patrons, UI)

- I found about the same amount of relevant items in SOC and DOC. (two patrons, LC; four patrons, NYSL)
- I found no relevant items on my topic in SOC or DOC. (one patron, LC; two patrons, NYSL)
- I found relevant and different items in both SOC and DOC. (one patron, LC)

Patrons were asked in post-search interviews to choose which system they would prefer the next time they needed to conduct an online catalog search. The results in tables 33 and 34 show that the amount of relevant information retrieved and displayed in online searches for a topic is related to patrons' system preference. Patrons who retrieved and displayed relevant items in a SOC and DOC search preferred the system in which they retrieved a greater amount of relevant items.

In post-search interviews, patrons gave their reasons for preferring DOC as the system they would want to search in the future based on the amount of relevant items retrieved and displayed in an online search in DOC for a given topic.

- I got more relevant information in DOC in my search. (one patron, UI)
- DOC is easy to use and quickly and easily led me to more relevant items on my topic than did SOC. (two patrons, PLCFC)
- DOC provided more items on my topic than did SOC. DOC's search was more comprehensive. (four patrons, NYSL)

Similarly, patrons gave their reasons for preferring SOC as the system they would want to search in the future based on the amount of relevant items retrieved and displayed in an online search in SOC for a given topic.

- I retrieved more relevant items in SOC than in DOC. (one patron, LC; one patron, NYSL; three patrons, PLCFC)
- I found relevant items and other unexpected items of interest in SOC. (one patron, PLCFC)

There were patrons who preferred neither system for various reasons.

- Neither system provided relevant items. (two patrons, UI; two patrons, NYSL)
- I retrieved the same relevant items in SOC and DOC. (two patrons, UI; two patrons, NYSL)
- I felt that it was difficult to obtain any relevant items from either SOC or DOC on a seemingly familiar topic (Revolutionary War in New York State). (one patron, NYSL)
- I found information on my topic in both catalogs. (three patrons, LC)

Generally, patrons expressed satisfaction with the search performed in the catalog that yielded more relevant items. They also made a system preference based on the amount of relevant information retrieved in one of the two systems. Patrons expressed satisfaction with their SOC and DOC searches and made a system preference based on reasons besides the amount of relevant information retrieved and displayed in an online search (see section 8.8). In this discussion, we have highlighted only those choices and remarks made by patrons regarding the amount of relevant items retrieved and displayed in SOC and DOC searches. We will feature their choices and remarks for other reasons in subsequent sections.

Table 33. Patrons' System Preference and Estimated Recall

Greater estimated recall was attained for a given search topic in:	The next time you need to conduct a computer catalog search, will you choose: %SOC	%DOC	%No Difference
SOC	68	32	34
DOC	13	48	23
No difference	19	20	43
Number of cases =	75	50	35

Note: Chi square = 30.37, p < .001

Table 34. Patrons' System Preference and Comparison of the Amount of Useful Information Retrieved

Comparing SOC and DOC, I retrieved:	The next time you need to conduct a computer catalog search, will you choose: %SOC	%DOC	%No Difference
A greater amount of useful information in SOC than in DOC	75	8	28
About the same amount of useful information in both SOC and DOC	18	35	56
A lesser amount of useful information in SOC than in DOC	7	57	16
[a]Number of cases =	73	49	32

Note: Chi square = 74.48, p < .001

[a] The six searches in which patrons responded in categories other than those listed on the left were not included in this comparison.

7.4.3 Estimated Recall in the Sample Search Experiment

In table 35, the results of a GLM are shown for a comparison of estimated recall in SOC and DOC in the Sample Search Experiment. GLM was used in this analysis of estimated recall to identify effects such as library and first system searched (see also section 6.4.2). The results of the GLM in table 35 are virtually the same as the GLM results in table 28 for estimated recall in the Comparison Search Experiment; that is, there is one significant effect--the system effect (F = 4.13, p < .0473)--which indicates that estimated recall in SOC and DOC are different. Table 36 contains the average estimated recall scores for library staff searches in the Sample Search Experiment at the four participating libraries. At the same three participating libraries as in the Comparison Search Experiment (LC, NYSL, PLCFC), average estimated recall scores in SOC exceeded the average estimated recall scores in DOC, and the differences between the two scores were significant. Estimated recall scores in SOC ranged from a low of 66% at LC to a high of 79% at NYSL; estimated recall scores in DOC ranged from a low of 50% at NYSL to a high of 69% at UI. The differences between estimated recall scores for SOC and DOC searches at the university was not significant. Furthermore, DOC's estimated recall score at UI (69%) exceeded SOC's estimated recall score at LC (66%).

Table 35. GLM for Estimated Recall in the Staff Searches

Sources of Variance	df	SS	MSS	F	Pr > F
Total	359	32.4798			
Library	3	0.5693	0.1897	1.30	0.2844
First system searched	1	0.1362	0.1362	0.93	0.3387
Library X First system searched	3	0.0570	0.019	0.13	0.9379
Between Staff error	52	7.6007	0.1462		
System (SOC or DOC)	1	0.2559	0.2559	4.13	0.0473
Library X System	3	0.3132	0.1044	1.68	0.1803
First system searched X System	1	0.0270	0.0270	0.44	0.5119
Library X First system searched X System	3	0.0285	0.0095	0.15	0.9238
Within staff error	52	3.2233	0.0619		

Table 36. Average Estimated Recall Scores in Staff Searches

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
1. Estimated recall	66%[a]	62%[a]	79%[a]	50%[a]	76%[b]	67%[b]	72%	69%	73%[c]	63%[c]
a. In n of 45 searches, SOC estimated recall exceeded DOC estimated recall	22		21		22		21		86 (48%)	
b. In n of 45 searches, DOC estimated recall exceeded SOC estimated recall	18		11		16		17		62 (34%)	
c. In n of 45 searches, SOC and DOC estimated recall were equal	5		13		7		7		32 (18%)	
Number of Cases =	45		45		45		45		180 (100%)	
2. Combined total number of relevant items retrieved and displayed	245		247		365		284		1141	
3. Number of relevant items retrieved and displayed	162	151	195	124	277	243	204	197	838	715

[a] Difference between the two means for SOC and DOC are significant ($z \geq 4.11$, $p < .001$).
[b] Difference between the two means for SOC and DOC are significant ($z \geq 2.23$, $p < .03$).
[c] Significant system effect was obtained (see table 35).

In table 37, the percentages of matched relevant items, i.e., items retrieved and displayed in both SOC and DOC searches, are shown. Overall, two of every five relevant items retrieved and displayed in a DOC search by staff were unique and were not retrieved and displayed in a SOC search for the same topic. The percentage of matched relevant items retrieved and displayed in DOC searches was lowest at LC in the Comparison Search Experiment where 45% of the relevant items retrieved in DOC matched relevant items in a SOC search for the same topic.

The number of items judged relevant by staff in a search in one system and possibly relevant in a search in the other system was greater than this number in the patron searches (see tables 30 and 37, row 4). In the Comparison Search Experiment, the same searcher performed relevance assessments whereas two different searchers performed the relevance assessment in the Sample Search Experiment. Conflicting relevance assessments in the latter experiment accounted for 10% of the relevant SOC output and 12% of the relevant DOC output. The number of items judged relevant in a search in one system and nonrelevant in a search in the other system was also greater than this number in the patron searches (table 30, row 5).

The percentages of matched relevant items retrieved and displayed in experimental online catalog searches in the Comparison Search Experiment (table 30) were smaller than the percentages for the same items in the Sample Search Experiment (table 37). This difference surprised us because, in the former experiment, the same library patron performing a search in SOC for a topic of interest also performed a search in DOC for the same topic of interest. In the latter experiment, two different library staff members performed a search in SOC and in DOC for the same topic. We expected that fewer matched relevant items would be retrieved and displayed in the latter instance--Sample Search Experiment with library staff--because two different staff members performed SOC and DOC searches for the same topic. In fact, the opposite was true.

Table 37. Matched Relevant Items in Staff Searches

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
1. Percentage of matched relevant items retrieved and displayed in 45 SOC and 45 DOC searches	42%	45%	37%	58%	56%	64%	56%	58%	49%	57%
2. Number of matched relevant items retrieved and displayed in 45 SOC and 45 DOC searches	68		72		155		115		410	
3. Number of relevant items retrieved and displayed in 45 SOC and 45 DOC searches	162	151	195	124	277	243	204	197	838	715

Table 37. Matched Relevant Items in Staff Searches (continued)

	LC SOC	LC DOC	NYSL SOC	NYSL DOC	PLCFC SOC	PLCFC DOC	UI SOC	UI DOC	Total (Four Libraries) SOC	Total (Four Libraries) DOC
4. Number of matched items in #2 above judged relevant in SOC output and possibly relevant in DOC output, or vice versa (i.e., conflicting relevance assessments considered relevant in this analysis)	17		22		26		22		87	
5. Number of matched items judged relevant and nonrelevant in SOC and DOC output (i.e., conflicting relevance assessments considered nonrelevant in this analysis)	6		7		1		9		23	

After some thought and review of the data, we decided that a procedural difference in the assignment of search topics in the Comparison Search Experiment and Sample Search Experiment was largely responsible for the greater percentage of matching relevant items retrieved and displayed by library staff than patrons. In the Comparison Search Experiment, library patrons performed online searches for a topic of their own choosing. In the Sample Search Experiment, library staff performed online searches for assigned topics. We felt that library patrons felt freer than library staff to enter subject access points into the catalog that were not exactly the same as the terminology of their expressed topics of interest. However, library staff felt compelled to enter subject terms into the catalog that were either exactly the same as the terminology of the assigned topic of interest or a partial representation (minus one or two words) of the assigned topic of interest. Since the subject terms entered by library staff were the same in both SOC and DOC searches, there would be greater overlap in the output of the two searches than in two searches in which the searchers did not enter the same subject terms. We satisfied our explanation by examining every SOC and DOC user-entered term in the Comparison Search and Sample Search Experiments and entering it into one of the following three categories and subcategories:

1. Exact representation of the expressed topic (in the Comparison Search Experiment) or assigned topic (in the Sample Search Experiment). Example: The patron phrased his expressed topic as "Television advertising" and entered "Television advertising" into the catalog.
    a. Exact letter-for-letter match
    b. Exact letter-for-letter match except for singular and plural word endings
    c. Exact letter-for-letter match except for all other word endings, e.g., -ed, -ing, -ly
    d. Exact letter-for-letter match except for abbreviations
    e. Exact letter-for-letter match except for spelling variants

2. Partial representation (of the expressed topic or assigned topic). Example: The patron phrased his expressed topic as "Television advertising" and entered "Television" into the catalog.

    a-e. Same as 1.a-1.e above.

3. Different representation (of expressed topic or assigned topic).
    a. Synonym entered that was more general than the expressed or assigned topic
    b. Synonym entered that was more specific than the expressed or assigned topic
    c. Synonym entered that was related to the expressed or assigned topic
    d. Other (or none of the above 3.a-c)

User-entered terms were described by one of the three categories and one of the fourteen subcategories in table 38. At all four participating libraries, library staff were more likely than patrons to stick to the terminology of the assigned topic by entering a subject access point that was an exact or partial representation of the assigned topic. Only 19% of access points entered by library staff were a different representation of the assigned topic, while 36% of access points entered by patrons were a different representation of their expressed topics. When library staff entered access points that were different from assigned topics, the majority of these access points were more general terms than the assigned topic. When library patrons entered access points that were different from their expressed topics, these access points were pretty evenly distributed into categories for more general terms, more specific terms, or terms categorized as "other." Examples of "other" terms are the access point "brain" entered in a search for "detective movies," "swimming" entered in a search for "basketball," and "soap operas" entered in a search for "television commercials." Only 1.4% of library staff's access points were categorized into the "other" category. Examples are "Samuel A. Carlson" entered in a search for "Jamestown," "Shakers" entered in a search for "Geography of Columbia County" (NY), and "Public relations" entered in a search for "Ghana's economics, employment, and industry."

Table 38. Subject Terms Entered by Patrons and Staff

	LC Patrons		LC Staff		NYSL Patrons		NYSL Staff		PLCFC Patrons		PLCFC Staff		UI Patrons		UI Staff		Total (Four Libraries) Patrons		Staff	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1. Exact representation (total 1.a-e)	90	(26%)	137	(47%)	103	(33%)	55	(19%)	142	(48%)	137	(53%)	155	(55%)	213	(74%)	490	(40%)	542	(48%)
a. Letter-for-letter match	81		119		93		48		128		130		140		202		442		499	
b. Except singular and plural word endings	3		5		0		0		3		3		5		8		11		16	
c. Except all other word endings	1		10		0		1		0		3		1		2		2		16	
d. Except abbreviations	0		2		0		2		1		0		0		0		1		4	
e. Except spelling variants	5		1		10		4		10		1		9		1		34		7	
2. Partial representation (total 2.a-e)	110	(31%)	92	(31%)	84	(27%)	162	(57%)	51	(17%)	79	(31%)	58	(21%)	42	(15%)	303	(24%)	375	(33%)
a. Letter-for-letter match	78		81		60		136		44		60		40		38		222		315	
b. Except singular and plural word endings	16		4		2		9		0		8		2		2		20		23	
c. Except all other word endings	5		4		9		12		0		9		15		2		29		27	
d. Except abbreviations	2		2		8		1		1		0		0		0		11		3	
e. Except spelling variants	9		1		5		4		6		2		1		0		21		7	
3. Different representation (total 3.a-d)	151	(43%)	66	(22%)	124	(40%)	67	(24%)	106	(35%)	40	(16%)	66	(24%)	33	(11%)	447	(36%)	206	(19%)
a. More general term	55		38		62		35		19		25		20		20		156		118	
b. More specific term	44		23		29		10		63		8		28		8		164		49	
c. Related term or synonym	5		2		2		14		1		7		4		0		12		23	
d. Other	47		3		31		8		23		0		14		5		115		16	
	351		295		311		284		299		256		279		288		1240	(100%)	1123	(100%)

Note: Chi square = 93.5, $p < .0001$

The tallies in table 38 also tell us about the conceptual relationships between library patrons' expressed topics and what they enter into the online catalog. In general, library patrons enter access points into the catalog that are exact representations (40%) of their expressed topic (table 38, rows 1.a-1.e) or broader in concept (37%) than their expressed topics (table 38, rows 2.a-2.e and 3.a). Comparatively, fewer access points are entered by patrons that are more specific (13%) than their expressed topics (table 38, row 3.b). This holds true for library staff performing online searches for assigned topics, particularly with regard to access points that are more specific than assigned topics. Only 4% of library staff-entered access points were more specific than assigned topics.

The statistics in table 38 shed light on the reason why the percentage of matched relevant items retrieved and displayed in experimental online catalog searches was greatest in the Sample Search Experiment in which two different library staff members performed searches for the same topic in SOC or in DOC. That is, the searching terminology entered into SOC and DOC by library staff was the same or almost the same as the terminology of the assigned topic. In contrast, the searching terminology entered into SOC and DOC by library patrons was frequently different than the terminology of patrons' expressed topics. The Comparison Search Experiment with library patrons was a more authentic and realistic scenario of online catalog searching than the Sample Search Experiment because library patrons were searching SOC and DOC with their own search topics. Thus, the number and percentage of matched relevant items retrieved and displayed by library patrons in the Comparison Search Experiment (table 30) are probably more accurate indications of the overlap in relevant items in SOC and DOC subject searches.

In the Sample Search Experiment, staff were asked the same question as patrons were asked regarding their satisfaction with the search, viz., in relation to what you were looking for, would you say your search was more satisfactory using SOC or DOC or was there no difference between the two systems? We compared staff responses to this question to the system that attained the higher estimated recall score in an online search for a given topic. The results of the comparison are shown in table 39 and are very similar to the results in a comparison of these data in the Comparison Search Experiment (see table 31). The results of the comparison of staff data show that the majority of staff expressed satisfaction with the search in SOC or in DOC whenever the system yielded higher estimated recall; however, staff did not express satisfaction with the search in SOC or DOC when the estimated recall of searches in these two systems was equal.

In post-search interviews, some library staff based their reasons for choosing SOC or DOC as the system providing satisfaction in the search on the amount of relevant items retrieved in the online search. Their reasons for choosing SOC or DOC were similar.

- I retrieved more relevant items in SOC than in DOC. (one staff, LC; three staff, NYSL; two staff, UI)

- I was able to find relevant items in DOC but not in SOC. (one staff, PLCFC)

- I was able to find relevant items in SOC but not in DOC. (two staff, NYSL; four staff, UI)

- I found relevant items in DOC. (four staff, UI)

Staff also identified reasons why they were unable to choose between SOC and DOC and felt that there was no difference in their satisfaction with the search in SOC or DOC.

- I obtained satisfactory results in both systems. (nine staff, LC; seven staff, PLCFC)

- DOC and SOC yielded relevant items with little difficulty. (five staff, NYSL)

- Both searches were successful in SOC and DOC. (one staff, NYSL)

Table 39. Staff Search Satisfaction and Estimated Recall

Greater estimated recall was attained for a given search topic in:	In relation to what you were looking for, was the search more satisfactory in: %SOC	%DOC	%No difference
SOC	53	24	32
DOC	18	47	34
No difference	29	29	34
Number of cases =	82	66	32

Note: Chi square = 18.0, p < .01

Table 40. Staff System Preference and Estimated Recall

Greater estimated recall was attained for a given search topic in:	The next time you need to conduct a computer catalog search, will you choose: %SOC	%DOC	%No difference
SOC	47	42	20
DOC	35	42	48
No difference	18	16	32
Number of cases =	57	69	54

When library staff had completed online searches for six different topics in the Sample Search Experiment, they were asked to choose which system they would prefer the next time they needed to conduct an online catalog search. The results in table 40 show that the amount of relevant information retrieved and displayed in online searches for a topic was not related to staff system preference. In general, staff were pretty evenly divided by a preference for SOC or DOC, but more staff preferred DOC than SOC. Unlike library patrons, a few staff cited reasons for system preference that were connected to relevant items retrieved and displayed; however, most staff chose reasons other than the amount of relevant information retrieved and displayed on which to base their system preference (see section 8.8). Reasons connected with the amount of relevant items retrieved are the following:

- SOC retrieved more items in my searches. (one staff, PLCFC)
- I had satisfactory results in both catalogs. (one staff, PLCFC)

- I had success in both catalogs, depending on the topic searched. (three staff, LC)

- SOC directed me to relevant items with a minimum of effort on my part. (one staff, NYSL)

In the Sample Search Experiment, library staff had performed six online searches in SOC and DOC for six different topics. Staff did not perform searches for the same topic in SOC and DOC. Since the search topics were different, it was not as straightforward in the Sample Search Experiment for staff to compare the results of two searches on SOC and DOC, particularly with respect to the amount of relevant items retrieved and displayed. Furthermore, library staff members were asked to make a system preference in view of six online searches for different topics, not just two searches for the same topic. Staff were probably less likely than patrons to compare the results of any one search or one pair of searches when making their system preference. Library staff expressed satisfaction with their SOC and DOC searches and made system preferences based on reasons besides the amount of relevant information retrieved in an online search. In this discussion, we have featured only those choices and remarks made by staff regarding the amount of relevant items retrieved and displayed in SOC and DOC searches and will highlight their choices and remarks for other reasons in subsequent sections.

7.5 Precision in Experimental Online Catalog Searches

7.5.1 Defining Precision

Precision is defined as "the proportion of items (whether actual documents or references to them) retrieved and delivered that the requester judges relevant" (Lancaster 1977, 145). In practice, the precision of an online search is much easier to measure than the recall of an online search for the following reasons. When the online searcher completes an online search, the result of the search is output, usually in the form of a list of items, references, or citations retrieved from the system's database. In full text databases the output can be the actual documents instead of references (which are, in fact, document surrogates) to them. In SOC and DOC, the output is a list of items (i.e., references to books with subject information). The individual items in the output can be reviewed by a judge, e.g., searcher, person who generated the search query, subject specialist, and each item can be assessed according to relevance to the search query. When individual items have been reviewed by a judge, the relevant items and nonrelevant items can be counted up in separate tallies and expressed in a precision proportion:

$$\text{Precision score of search a} = \frac{\text{Number of relevant items retrieved in search a}}{\text{Number of items retrieved in search a}}$$

High-precision searches are achieved when the output contains many relevant items, and low precision searches are achieved when the output contains few relevant items. Conflicting relevance assessments were resolved as follows for identifying relevant items:

1. An item judged relevant by the SOC searcher and possibly relevant by the DOC searcher was deemed relevant

2. An item judged possibly relevant by the SOC searcher and relevant by the DOC searcher was deemed relevant

3. An item judged relevant by the SOC searcher and not relevant by the DOC searcher was deemed not relevant

4. An item judged not relevant by the SOC searcher and relevant by the DOC searcher was deemed not relevant

In both the Comparison Search and Sample Search Experiments, the online searches of library patrons and staff were recorded on a hardcopy printout from the beginning of the search to the end of the search. Library patrons and staff retrieved items in searches but did not display all items retrieved. Thus, all items retrieved in a search were not recorded on the hardcopy printout. Only items displayed in a search were recorded on the hardcopy printout. Since the items recorded on the hardcopy printout were presented to online retrieval test participants for performing relevance assessments, precision scores in the online retrieval tests for this study were based only on the items retrieved and displayed in online searches, not on the items retrieved in online searches. The precision score used in the online retrieval tests is:

$$\text{Precision} = \frac{\text{Number of unique relevant items retrieved and displayed in search a}}{\text{Total number of items retrieved and displayed in search a}}$$

In the online retrieval tests, precision was affected by the order in which retrieved items were displayed (because the online retrieval test participants displayed only a fraction of the items retrieved). SOC and DOC displayed retrieved items in shelflist order. In the analysis of retrieval test results, we will see how this order affects the precision of online searches (see section 8.3.6).

In online retrieval tests, participants judged the relevance of references (with subject information) to library material, not the actual full text of a book or document. Their relevance assessment could have been much different if they had based it on the full text of a book or document.

Obtaining high or low precision in a search is sometimes affected by the judge performing relevance assessments. Relevance is a personal and often subjective evaluation. An item judged relevant by one person might be judged nonrelevant by another person. Moreover, an item judged nonrelevant by one person might be judged relevant by the same person at another time or place or under different circumstances. For the reasons described above, precision can be an unreliable criterion for measuring the performance of an online system. In our analysis of the precision of experimental online catalog searches, we used precision scores to identify problems and inadequacies of the capabilities of SOC or DOC; we did not use precision scores to compare SOC and DOC and to determine the best of the two systems.

7.5.2 Precision in the Comparison Search Experiment

In table 41, the results of a GLM are shown for a comparison of precision in SOC and DOC for patron searches conducted during the Comparison Search Experiment. The results of the GLM show three significant effects: (1) system effect ($F = 14.17$, $p < .0002$); (2) library effect ($F = 4.08$, $p < .0081$); and (3) interaction of the system and library effect ($F = 4.72$, $p < .0037$).

In table 42, the average precision scores are listed for each of the four participating libraries. At three of the four participating libraries (LC, NYSL, PLCFC), the average precision scores in SOC searches exceeded precision scores in DOC searches. The average precision scores at the University of Illinois were equal for SOC and DOC searches. This difference in the precision scores among the four participating libraries helps to explain the significant library effect in the GLM (table 41).

Table 41. GLM for Precision in Patrons' Searches

Source of Variance	df	SS	MSS	F	Pr > F
Total	319	2,904.3			
Library	3	156.3	52.1	4.08	0.0081
First system searched	1	4.3	4.3	0.34	0.5606
Library X First system searched	3	72.8	24.3	1.90	0.1301
Between patron error	152	1,939.3	12.8		
System (SOC or DOC)	1	55.9	55.9	14.17	0.0002
Library X System	3	55.8	18.6	4.72	0.0037
First system searched X System	1	2.8	2.8	0.72	0.3978
Library X First system searched X System	3	19.0	6.3	1.61	0.1887
Within patron error	152	599.1	3.9		

The significant interaction effect of library and system is explained by the different precision scores from library to library. At the PLCFC, the 42% precision score in DOC searches exceeded the precision scores of SOC searches at LC, NYSL, and UI. The average precision score of SOC searches at PLCFC is unusually high (65%) and the difference between the average precision score of SOC searches at PLCFC and the other three participating libraries is as much as 31%.

Monitoring patrons' subject searches in the Comparison Search Experiment at the PLCFC, we noticed that some patrons did not always stick to their expressed topics when searching the experimental online catalog. For example, one searcher's expressed topic was "Camping vehicles." Once he began searching, he did not find "Camping vehicles" listed in a display of alphabetically arranged Relative Index entries, but his eye caught the entry "Carbines--hunting and shooting sports--game." He displayed a few items, was pleased by them, and was not very disappointed that he had not found any relevant items on "Camping vehicles" in his experimental online catalog searches. Another patron at PLCFC was browsing an alphabetically arranged list of subject headings for the heading "Racquetball" when he saw the subject heading "Reagan, Ronald, 1911-" listed. He became interested immediately in this new topic, displayed the items bearing this subject heading, and judged them relevant even though he was originally looking for information on "Racquetball." In these two examples of PLCFC patrons' searching behavior, patrons were somewhat lax in defining their expressed need and altered it as necessary when browsing the experimental online catalog. Changing their needs according to the results of the online catalog search had an effect on the precision of the search and might have inflated the average precision scores at PLCFC. These inflated precision scores at PLCFC help to explain the significant interaction effect of library and system in the GLM (table 41).

Table 42. Average Precision Scores in Patrons' Searches

	LC SOC	LC DOC	NYSL SOC	NYSL DOC	PLCFC SOC	PLCFC DOC	UI SOC	UI DOC	Total (Four Libraries) SOC	Total (Four Libraries) DOC
1. Precision	39%^{b}	26%^{b}	41%^{a}	34%^{a}	65%^{b}	42%^{b}	34%	34%	44%^{c}	33%^{c}
a. In n of 40 searches, SOC precision exceeded DOC precision	24		22		27		18		91 (57%)	
b. In n of 40 searches, DOC precision exceeded SOC precision	9		11		9		18		47 (29%)	
c. In n of 40 searches, SOC and DOC precision were equal	7		7		4		4		22 (14%)	
Number of cases =	40		40		40		40		160 (100%)	
2. Total number of items retrieved and displayed	468	488	460	361	385	367	379	376	1692	1592
3. Number of relevant items retrieved and displayed	183	123	190	122	251	153	128	127	752	525
4. Total number of matched items retrieved and displayed	73		99		85		72		329	
5. Percentage of matched items retrieved and displayed	16%	15%	22%	27%	22%	23%	19%	19%	19%	21%

[a] Differences between the two means for SOC and DOC were significant ($z > 2.20$, $p < .05$).
[b] Differences between the two means for SOC and DOC were significant ($z \geq 4.46$, $p < .001$).
[c] Significant system effect was obtained (see table 41).

In rows numbered 4 and 5 in table 42, the numbers and percentages (respectively) of matched items retrieved and displayed in both SOC and DOC searches are given. These figures represent the number of items retrieved and displayed in SOC and DOC searches for the same topic regardless of an item's relevance to the search topic; thus, matched items that were judged possibly relevant and items judged nonrelevant by searchers were counted as well as matched items judged relevant. On the average, one of every five items retrieved and displayed in a DOC search for a patron's topic was also retrieved and displayed by the patron in a SOC search for the same topic.

In post-search interviews, library patrons talked about the differences between SOC and DOC that they had noticed with regard to the items retrieved and displayed. SOC's output seemed specific to the searchers' topic of interest and DOC's output seemed more general than the former.

- DOC produced information on broad topics. SOC zeroed in on information specific to my topic. (three patrons, LC)
- DOC yields more items (than SOC) in response to my entered topic. (one patron, NYSL)
- The displayed items in DOC were broader in concept than those in SOC. (twelve patrons, PLCFC)
- It seems like you have to look through a lot of items to find relevant ones. (two patrons, UI)

In post-search interviews, patrons were asked which system was more satisfactory for the search. We compared patrons' responses to this question with the system in which their online search yielded the greater precision. The results of this comparison are shown in table 43. In general, patrons did not express satisfaction with the search in the system in which the higher precision was obtained. In these interviews, patrons were also asked to make a system preference. We compared patrons' responses to this question with the system in which their online search yielded the greater precision. The results of this comparison were similar to the results in table 43. Thus, a separate table was not drawn up to show results. Based on these two comparisons of search satisfaction and system preference with precision, we concluded that there was no relationship between patrons' search satisfaction and the precision of their online searches, or between patrons' system preference and the precision of their online searches.

Table 43. Patrons' Search Satisfaction and Precision

Greater precision was attained for a given search topic in:	In relation to what you were looking for, was the search more satisfactory in:		
	%SOC	%DOC	%No Difference
SOC	67	51	41
DOC	23	43	27
No difference	10	6	32
Number of cases =	79	47	34

7.5.3 Precision in the Sample Search Experiment

In table 44, the results of GLM are shown for a comparison of precision in SOC and DOC in the Sample Search Experiment. The results of the GLM show two significant effects: (1) system effect ($F = 4.05$, $p < .0494$); and (2) library effect ($F = 5.67$, $p < .002$). These same two effects were obtained in the GLM for a comparison of precision in the Comparison Search Experiment. These Sample Search Experiment results tell us that there is a difference in precision depending on the system (SOC or DOC) accessed by the staff and the library in which the search was performed.

Average precision scores are listed for each of the four participating libraries in table 45. At each of those libraries, the SOC precision score exceeded the DOC precision score, but the difference between these two scores was only significant at NYSL and PLCFC. The SOC and DOC precision scores at PLCFC were higher than their counterparts at the three other participating libraries. In fact, DOC precision in PLCFC searches (61%) exceeded SOC precision at LC (55%), NYSL (56%), and UI (57%).

In post-search interviews, staff, like patrons, compared the specificity of SOC's output to the generality of DOC's output. This difference between the items retrieved and displayed in SOC and DOC is a difference in the precision of the two systems, although searchers did not specifically mention precision in their remarks:

- It's easier to pinpoint relevant items on specific topics in SOC. DOC gives information on general topics. (three staff, PLCFC)

- I retrieved more items in DOC. (one staff, PLCFC, three staff, UI)

- DOC produced more items and ones on general topics; SOC obtained items on specific topics. (three staff, LC)

- SOC is more specific than DOC. DOC is broader and more scholarly. DOC is like an encyclopedic arrangement and it can teach you about your subject. (one staff, LC)

In rows numbered 4 and 5 in table 45, the numbers and percentages (respectively) of matched items retrieved and displayed in both SOC and DOC searches are given. These figures represent the number of items retrieved and displayed in SOC and DOC searches for the same topic regardless of an item's relevance to the search topic; thus, matched items that were judged possibly relevant and items judged nonrelevant by searchers were counted as well as matched items judged relevant. On the average, approximately one of every three items retrieved and displayed in a DOC search for a topic in the Sample Search Experiment was also retrieved and displayed by another staff member in a SOC search for the same topic. This percentage of matched items retrieved and displayed in the Sample Search Experiment is greater than the percentage of overlap in the Comparison Search Experiment for the same reason as the difference in the percentage of matched relevant items in the two experiments--i.e., library staff stuck to the terminology of the assigned topic when entering terms into SOC and DOC, whereas patrons often deviated from the terminology of their expressed topics (see table 38 and section 7.4.3).

Table 44. GLM for Precision in Staff Searches

Sources of Variance:	df	SS	MSS	F	Pr > F
Total	359	31.5067			
Library	3	1.5129	0.5043	5.67	0.0020
First system searched	1	0.1679	0.1679	1.89	0.1751
Library X First system searched	3	0.0996	0.0332	0.37	0.7752
Between staff error	52	4.6217	0.0888		
System (SOC or DOC)	1	0.2947	0.2947	4.05	0.0494
Library X System	3	0.1222	0.0407	0.04	0.6481
First system searched X System	1	0.0570	0.0570	0.78	0.3803
Library X First system searched X System	3	0.0524	0.0175	0.24	0.8678
Within staff error	52	3.7847	0.0728		

Table 45. Average Precision Scores in Staff Searches

	LC SOC	LC DOC	NYSL SOC	NYSL DOC	PLCFC SOC	PLCFC DOC	UI SOC	UI DOC	Total (Four Libraries) SOC	DOC
1. Precision	55%	51%	56%[a]	40%[a]	69%[b]	61%[b]	57%	51%	60%[c]	52%[c]
a. In n of 45 searches, SOC precision exceeded DOC precision	19		23		26		23		91	(50%)
b. In n of 45 searches, DOC precision exceeded SOC precision	20		15		12		17		64	(36%)
c. In n of 45 searches, SOC and DOC precision were equal	6		7		7		5		25	(14%)
Number of cases =	45		45		45		45		180	(100%)
2. Total number of items retrieved and displayed	296	298	348	310	403	397	357	383	1404	1388
3. Number of relevant items retrieved and displayed	162	151	195	124	277	243	204	197	838	715
4. Total number of matched items retrieved and displayed	81		103		165		148		497	
5. Percentage of matched items retrieved and displayed	27%	27%	30%	33%	41%	42%	41%	39%	35%	36%

[a] Differences between the two means for SOC and DOC were significant ($z > 4.11$, $p < .001$).
[b] Differences between the two means for SOC and DOC were significant ($z \geq 2.23$, $p < .03$).
[c] Significant system effect was obtained (see table 44).

In post-search interviews, staff were asked which system was more satisfactory for the search. We compared staff responses to this question with the system in which their online search yielded the greater precision. The results of this comparison are shown in table 46. Staff expressed satisfaction with the search conducted in the system in which the higher precision was obtained. Post-search interviews were used to elicit from staff their reasons for expressing satisfaction with the search. Here are a few comments associated with precision:

- SOC led me directly and efficiently to relevant items. (nine staff, NYSL; seven staff, PLCFC; five staff, UI)
- DOC led me directly and efficiently to relevant items. (one staff, NYSL; three staff, LC)
- I was able to find relevant items in SOC, but not in DOC. (two staff, NYSL; four staff, UI)
- I was able to find relevant items in DOC, but not in SOC. (one staff, PLCFC; four staff, UI)

Table 46. Staff Search Satisfaction and Precision

Greater precision was attained for a given search topic in:	In relation to what you were looking for, was the search more satisfactory in:		
	%SOC	%DOC	%No Difference
SOC	55	24	17
DOC	22	44	28
No difference	23	32	55
Number of cases =	90	72	18

Note: Chi square = 24.065, p < .001

Library staff were also asked to make a system preference and state their reasons for choosing one system or the other. We compared their responses to the question on system preference with the system in which their online search yielded the greater precision. The results of this comparison were somewhat similar to the comparison in table 39, so a separate table was not drawn up. Staff preferred either SOC or DOC when searches in one of these systems yielded the greater precision, but they were divided equally between SOC and DOC when the precision of searches conducted in them were equal.

7.6 Discussion of Time Spent Searching, Estimated Recall, and Precision Results

In the online retrieval tests, we collected data that enabled us to figure the time spent searching, estimated recall, and precision of online searches. The results of time spent searching SOC and DOC were similar for patrons and staff. Searches in DOC took longer than searches in SOC, but the difference between the average times spent searching were small--2.1 minutes for patrons and 1.6 minutes for staff (see section 7.3; tables 21 and 26). However, patrons or staff members who were searching the experimental online catalog for the first time almost always took longer to search the first system than to search the next system regardless of which system they used first (i.e., SOC or DOC). Thus, SOC searches were longer than DOC searches when the patron or staff member accessed SOC first and vice versa (see tables 22 and 27).

The greater length of DOC searches was attributed to DOC's unique subject searching capabilities, online displays, and unique options to manipulate these displays, which most patrons and staff had never before encountered in online catalog searching. In the post-search interviews with online retrieval test participants, they cited reasons for their satisfaction with the search and their system preference that were related to the time spent searching the experimental online catalog. However, a quantitative analysis did not establish a statistical relationship between search satisfaction or system preference and the time spent searching. The difference in the average length of time taken to search SOC and DOC was between one and two minutes and, evidently, did not make much of an impression on online retrieval test participants.

Recall and precision are traditional criteria for evaluating the searching performance of online retrieval systems. Unfortunately, these criteria have serious drawbacks that often make recall and precision unreliable performance measures (sections 7.4.1 and 7.5.1). At best, both measures are indicators of problem areas in a retrieval system's capabilities that call for improvement, redesign, or enhancement. We used these measures to identify differences between the searching performance of SOC and DOC. We did not use these measures to compare the two systems to determine the better of the two.

The results of statistical analyses for estimated recall in searches conducted by library patrons or staff show that estimated recall is different with respect to SOC and DOC (see section 7.4; tables 28 and 35). In online searches at three of the four participating libraries, estimated recall was significantly greater in SOC searches than in DOC searches. At the University of Illinois, however, the estimated recall of SOC and DOC searches was virtually the same. The amount of overlap in relevant items retrieved was lower in the Comparison Search Experiment than in the Sample Search Experiment. Overall, two of every three relevant items retrieved and displayed in a DOC search for a given topic in the Comparison Search Experiment was unique and was not retrieved and displayed in a SOC search for the same topic (see table 30). Approximately two of every five relevant items retrieved and displayed in a DOC search for a given topic in the Sample Search Experiment were unique and were not retrieved and displayed in a SOC search for the same topic (see table 37). The numbers of matching relevant items between the two systems are small; thus, the majority of relevant items retrieved in DOC searches and used, in part, to determine estimated recall were unique relevant items that were not retrieved by SOC.

Library patrons and staff expressed satisfaction with the search in the system yielding greater estimated recall for the search, and in post-search interviews, gave reasons for their satisfaction with the search based on the amount of relevant items retrieved. Library patrons' system preference was also related to the system yielding greater estimated recall for the search.

Estimated recall, then, is an important criterion of search performance because it is a measure that makes SOC and DOC different and is related to searchers' satisfaction with the search and to patrons' system preference. Our analysis of estimated recall is limited thus far because the quantitative analyses only provide a general picture of online searches in SOC and DOC. We will single out these different subject search options in chapter 8 to find out which options yielded relevant items and which did not and to determine the reasons for a subject search option's failure to retrieve relevant items.

The results of statistical analyses for precision in searches conducted by library patrons and staff show that precision was different with respect to SOC and DOC (see section 7.5; tables 41 and 44). In online searches at three of the four participating libraries in the Comparison Search Experiment and at only two of the four participating libraries in the Sample Search Experiment, precision was significantly greater in SOC searches than in DOC searches. The amount of overlap in items retrieved was lower in the Comparison Search Experiment than in the Sample Search Experiment. Overall, one of every five items retrieved and displayed in a DOC search for a patron's topic was also retrieved and displayed by the patron in a SOC search for the same topic (regardless of the searcher's relevance assessment)(see table 42). Approximately one of every three items retrieved and displayed in a DOC search for a topic in the Sample Search Experiment was also retrieved and displayed by another staff member in a SOC search for the same topic (see table 45). The numbers of matching items and matching relevant items between the two systems are small. Thus, the majority of items and relevant items retrieved and displayed in DOC searches and used to determine precision were unique items and unique relevant items which were not retrieved and displayed in SOC.

Precision did not have much of an impact on patrons' satisfaction or system preference, but it was related to library staff's satisfaction with the search (see table 46) and their system preference.

Precision is also an important criterion of search performance because it is a measure that makes SOC and DOC different and is related to staff satisfaction with the search, and, to a lesser extent, their system preference. Our analyses of estimated recall and precision have been limited thus far because the quantitative analyses only provide a general picture of online searches in SOC and DOC. We need to focus on the search performance of the four different subject searches of DOC to find out whether these subject searches were comparable in performance or yielded different results. Chapter 8 provides an in-depth analysis and failure analysis of the experimental online catalog's searching capabilities.

8. Failure Analysis of Subject Searching Options

8.1 Introduction

The last chapter on estimated recall and precision in experimental online catalog searches provided an overview of the performance of SOC and DOC with respect to these measures. In this chapter, we highlight the experimental online catalog's subject searching options to find out whether these options effectively direct searchers to relevant items and how these options can be improved to provide better performance.

To analyze the performance of the experimental online catalog's subject searching options, we categorized every user-entered term into the SOC or DOC subject searching option chosen by the user in online retrieval tests and tallied how many times each term led the user to relevant items. This process is demonstrated in table 47 in which every user action and search outcome were characterized by the entry of a term into the catalog and by the selection of a term from the catalog. Every term entered by searchers was categorized into one of the subject search options (i.e., SA, SS, SD, or SC). The number of items retrieved by the user-entered term was also recorded. The result of the user's entry of a term was recorded as the user-selected term and was categorized into one of the catalog options that was the most significant option that led the user to create a set of items. The number of items retrieved by the user-selected term was also recorded on tally sheets.

An example of this process is shown in table 47 for a library patron's search in DOC for "French government: National trade and monetary policy." The first of six user-entered terms was entered using the direct search (SD) option. The search resulted in the creation of a set of 215 items from which the user displayed only one item and judged it nonrelevant. The second user-entered term, also entered using the direct search, retrieved no items. In a direct search retrieving no items, the user only has the option to start over by entering another term. Thus, there is no "outcome," so to speak, or no user-selected term in a direct search in which the user-entered term retrieves no items.

The third user-entered term was entered using the alphabetical search (SA). In the alphabetical search, DOC and SOC always respond with a list of ten alphabetically arranged Relative Index entries or subject headings. In the example, the user did not select a listed Relative Index entry--which accounts for the absence of an outcome to this transaction--but started over using a direct search for "french economy." This direct search retrieved one item, which the searcher judged relevant.

The fifth term entered by the searcher did not match a Relative Index entry (which is evident by the zero in the "Number of Items Retrieved" column in the

"Action" portion of the table). In the outcomes to the search, however, the user entered two options that led to the creation of separate sets for four items and 115 items through the ST (search subject outline for a listed topic) and BG (browse general topics) options, respectively. The sixth term entered by the searcher also did not match a Relative Index entry. However, in the outcome, the user entered an option that led to the creation of a set for 124 items that could be displayed by the user and their relevance determined.

Table 47. Example of User-entered and User-selected Terms in a DOC Search

Search	Option	User-entered Term	Number of Items Retrieved
ACTION: #2	1. SD	monetary policy	215
	2. SD	france monetary policy	0
	3. SA	french monetary policy	0
	4. SD	french economy	1
	5. SA	french economy	0
	6. SA	french policy	0

	Option	User-selected Term	Number of Items Retrieved	Number of Items Displayed	Relevant Items	Possibly Relevant Items	Nonrelevant Items
OUTCOMES:	1. SD	monetary policy	215	1			1
	4. SD	french economy	1	1	1		
	5. ST	382.71 Free trade (No tariff)	4	0			
	BG	382.0 General Aspects	115	1			1
	6. SL	Free-trade--international commerce (4) Free-enterprise economy (13)	124	3			3
		• • •					

User-entered terms categorized into SOC's alphabetical search and DOC's alphabetical, subject outline, and call number searches can result in zero items, but the system's feedback in the form of alphabetical lists or logical outlines can affect the outcome of the search by directing the searcher to relevant items through the selection of a listed subject heading, Relative Index entry, or Schedule caption. Thus, these subject searches (i.e., SOC's alphabetical search and DOC's alphabetical, subject outline, and call number searches) go hand in hand with other SOC and DOC options to enable searchers to find relevant items.

The subject searching options of the experimental online catalog are listed in tables 48 and 49 along with the number and percentage of times each option directed patron and staff searchers to relevant items. The figures in these tables were obtained from analyses of the kind described above and in table 47 of all 320 patron searches in the Comparison Search Experiment and all 360 staff searches in the Sample Search Experiment.

Comparisons of the number of times experimental online catalog users selected a particular subject search option in SOC and DOC cannot be made fairly because SOC featured three subject search options and DOC featured four subject search options. However, it is interesting that the listing of SOC and DOC options in the order in which they were presented to online searchers in options menus is not the same as a rank-ordered listing of SOC and DOC options in the order of their selection by SOC and DOC searchers. That is, the SOC options menu listed subject search options in the following order with the number in parentheses indicating the rank order of the number of times each option was chosen by SOC searchers:

SA Search alphabetically for subject (2)
SD Search directly for subject (1)
SC Search for call number (3)

The DOC options menu listed subject search options in the following order. The number in parentheses indicates the rank order of the number of times each option was chosen by DOC searchers.

SA Search alphabetically for subject (2)
SS Search subject outline for subject (3)
SD Search directly for subject (1)
SC Search for call number (4)

Both patrons and staff chose the direct search (SD) in SOC and DOC more times than any other subject search in the experimental online catalog. Patrons and staff might have best understood the two-line description of the direct search of the three or four descriptions of SOC and DOC subject searches which resulted in their selecting this option most frequently. Also, the direct search had the best track record of all the subject search options for directing searchers to relevant items (see table 48, row 3, and table 49, row 3). The percentage of times that DOC's direct search directed searchers to relevant items exceeded the percentage of times that SOC's direct search directed searchers to relevant items at all libraries but NYSL in the Comparison Search Experiment. And the percentage of times that DOC's direct search resulted in zero items was less than the percentage of times that SOC's direct search resulted in zero items at all libraries but UI in the Comparison Search Experiment (see also sections 8.3.2 and 8.3.3).

Table 48. Experimental Online Catalog Capabilities Directing Patrons to Relevant Items

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
1. SA (alphabetical search) option										
a. Selected	65	31	50	41	78	39	67	41	260	152
b. Relevant items	1	0	0	0	5	0	7	0	13	0
c. Percentage of times SA option led directly to relevant items	2%	0%	0%	0%	6%	0%	10%	0%	5%	0%
d. Percentage of times SA option led to relevant items through supporting options (SOC: BB, BF, SL; DOC: BB, BF, BG, BS, SL, ST)	52%	23%	30%	27%	69%	26%	55%	49%	54%	32%
e. Percentage of times zero items retrieved	88%	97%	94%	100%	60%	100%	52%	98%	72%	99%
2. SS (subject outline search) option (not available in SOC)										
a. Selected	NA	59	NA	48	NA	44	NA	50	NA	201
b. Relevant items	NA	2	NA	2	NA	1	NA	NA	NA	5
c. Percentage of times SS option led directly to relevant items	NA	3%	NA	4%	NA	2%	NA	NA	NA	3%
d. Percentage of times SS option led to relevant items through supporting options (DOC: BG, BP, BS, SL, GN)	NA	15%	NA	23%	NA	32%	NA	48%	NA	29%
e. Percentage of times zero items retrieved	NA	44%	NA	54%	NA	25%	NA	56%	NA	45%

Table 48. Experimental Online Catalog Capabilities Directing Patrons to Relevant Items (continued)

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
3. SD (direct search) option										
a. Selected	116	90	97	75	80	57	78	50	371	272
b. Relevant items	36	34	40	28	26	27	28	23	130	112
c. Percentage of times SD option led directly to relevant items	31%	38%	41%	37%	33%	43%	36%	46%	35%	41%
d. Percentage of times zero items retrieved	35%	27%	41%	40%	33%	23%	23%	34%	34%	31%
4. SC (call number search) option										
a. Selected	24	7	8	7	6	6	18	8	56	28
b. Relevant items	4	0	3	0	0	1	3	1	10	2
c. Percentage of times SC option led directly to relevant items	17%	0%	38%	0%	0%	17%	17%	13%	18%	7%
d. Percentage of times SC option led to relevant items through supporting options (DOC: BG, BS, SL)	NA	14%	NA	29%	NA	50%	NA	13%	NA	25%
e. Percentage of times zero items retrieved	8%	0%	25%	29%	33%	33%	11%	13%	14%	18%

Table 49. Experimental Online Catalog Capabilities Directing Staff to Relevant Items

	LC SOC	LC DOC	NYSL SOC	NYSL DOC	PLCFC SOC	PLCFC DOC	UI SOC	UI DOC	Total (Four Libraries) SOC	Total (Four Libraries) DOC
1. SA (alphabetical search) option										
a. Selected	70	57	53	37	67	27	70	39	260	160
b. Relevant items	6	0	0	0	1	0	10	2	17	2
c. Percentage of times SA option led directly to relevant items	9%	0%	0%	0%	6%	0%	14%	5%	7%	1%
d. Percentage of times SA option led to relevant items through supporting options (SOC: BB, BF, SL; DOC: BB, BF, BG, BS, SL, ST)	33%	14%	58%	5%	49%	19%	53%	51%	48%	21%
e. Percentage of times zero items retrieved	71%	100%	92%	100%	73%	100%	53%	92%	71%	98%
2. SS (subject outline search) option (not available in SOC)										
a. Selected	NA	55	NA	43	NA	36	NA	52	NA	186
b. Relevant items	NA	3	NA	1	NA	8	NA	NA	NA	12
c. Percentage of times SS option led directly to relevant items	NA	5%	NA	2%	NA	22%	NA	NA	NA	6%
d. Percentage of times SS option led to relevant items through supporting options (DOC: BG, BP, BS, SL)	NA	15%	NA	9%	NA	44%	NA	29%	NA	23%
e. Percentage of times zero items retrieved	NA	24%	NA	30%	NA	8%	NA	40%	NA	27%

Table 49. Experimental Online Catalog Capabilities Directing Staff to Relevant Items (continued)

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
3. SD (direct search) option										
a. Selected	56	57	77	75	77	49	74	54	284	235
b. Relevant items	37	39	28	28	36	34	38	39	139	140
c. Percentage of times SD option led directly to relevant items	66%	68%	36%	37%	47%	69%	51%	72%	49%	60%
d. Percentage of times zero items retrieved	11%	5%	34%	23%	22%	16%	14%	6%	21%	13%
4. SC (call number search) option										
a. Selected	22	11	10	12	22	13	36	15	90	51
b. Relevant items	5	0	5	2	6	3	7	3	23	8
c. Percentage of times SC option led directly to relevant items	23%	0%	50%	17%	27%	31%	19%	20%	26%	16%
d. Percentage of times SC option led to relevant items through supporting options (DOC: BG, BS, SL)	NA	45%	NA	17%	NA	62%	NA	20%	NA	35%
e. Percentage of times zero items retrieved	0%	18%	10%	25%	5%	0%	39%	0%	18%	10%

The direct search's performance was not always a sterling performance. Approximately one of every three access points entered by patrons into DOC and SOC through the direct search resulted in zero items. The direct search provided searchers with no stimulus in the form of alphabetical or logical lists of terms to guide them to other terms which might have expressed their search topic. The performance of the direct search in the experimental online catalog is featured in section 8.3.

Overall, the alphabetical search in SOC and DOC seldom, if ever, led users directly to relevant items. The percentage of times that the alphabetical search led users directly to relevant items is connected to the user's ability to match a subject heading in SOC and a Relative Index entry in DOC letter-for-letter. When users chose the alphabetical search, they were only able to make an exact match of a subject heading approximately 6% of the time in SOC and a Relative Index entry approximately 1% of the time in DOC. Very few users were able to match a subject heading or Relative Index entry letter-for-letter. In fact, patrons matched subject headings and Relative Index entries as frequently (that is, infrequently!) as library staff. Fortunately, SOC and DOC are equipped with displays of alphabetically arranged subject headings and Relative Index entries to help users find an indexed heading or entry in the alphabetical neighborhood of their entered term and with options to enable users to select a listed term or manipulate the display. In the Comparison Search Experiment, DOC users were unable to match letter-for-letter a Relative Index entry that also directed them to relevant items. With the use of a supporting option to select (SL) entries from the alphabetical list and other options to browse the alphabetical list (BB or BF) or logical outline linked to listed entries, DOC users were able to find relevant items approximately one of every three times they used the alphabetical search, and SOC users were able to find relevant items approximately one of every two times they used the alphabetical search. The performance of the alphabetical search in the experimental online catalog is featured in section 8.5.

When used alone, the subject outline search seldom led users directly to relevant items. Like the alphabetical search, the subject outline search was supported by options that manipulated the display of logical outlines. When patrons enlisted the supporting options of the subject outline search, approximately two of every seven subject outline searches directed them to relevant items. When staff enlisted the supporting options of the subject outline search, approximately two of every nine subject outline searches directed them to relevant items.

Of all the subject searches in SOC and DOC, DOC's subject outline search differed most from searchers' experiences with the library catalog. The alphabetical and direct searches were more familiar to catalog searchers. The alphabetical search provided users with alphabetically arranged lists of terms. Regardless of the fact that DOC's list was composed of Relative Index entries, the arrangement of the entries in DOC was similar to the arrangement of subject headings in the traditional library catalog. The direct search in both systems allowed users to enter their own terms into the experimental online catalog and match their terms with keywords in the subject-rich fields of bibliographic records. The direct search did not force users to match subject headings or Relative Index entries letter-for-letter. In fact, the direct search probably reinforced what library catalog searchers have been doing right along, i.e., expressing their topics of interest in their own terms. However, DOC's subject outline search was different from searcher's library catalog experiences. It allowed searchers to express their topics of interest in their own terms and guided them to one or more areas of the bookshelves to find one or more relevant items displayed in the online catalog. Yet, the subject outline search approximated what library users have been doing all along by browsing the bookshelf, i.e., looking for books in the neighborhood of a book already identified in the online catalog (or traditional library catalog) search and judged relevant by the user. The performance of DOC's subject outline search is covered in section 8.4.

The overall results of the call number search in the experimental online catalog were a mixed bag in which the percentage of times that the call number search led users directly to relevant items ranged from 0% to 50% in SOC and 0% to 31%

in DOC. Sometimes the percentage of times that the call number search resulted in zero items in SOC was greater in DOC, and vice versa. About the only characteristic of call number searching in SOC and DOC common to both systems was that the searcher first had to know the correct call number to enter into the systems. The performance of the call number search is covered in section 8.6.

In this introduction to the subject searches of the experimental online catalog, the numbers and percentages of finding relevant items provide a very general picture of the performance of the catalog. Yet, these statistics tell us that the performance of the different subject searches are not all uniform, and that users had greater success in finding relevant items using certain searches and lesser success using other searches. In section 8.2, the specific reasons for failure of patron and staff searches are identified. In the next four sections, 8.3-8.6, the different subject searches of the experimental online catalog are placed in the spotlight and their ability to direct users to relevant items is featured.

8.2 Failure Analysis of Experimental Online Catalog Searches

In online retrieval tests, patrons performed a total of 320 subject searches and staff performed a total of 360 subject searches. We singled out searches conducted by patrons and staff that failed to retrieve relevant items and identified the reasons why the searches had failed.

Users' searches failed in three situations: (1) SOC and DOC searches for the same topic failed; (2) the SOC search for a topic failed and the DOC search for the same topic succeeded; and (3) the DOC search for a topic failed and the SOC search for the same topic succeeded. Sections 8.2.1-8.2.3 describe the reasons for search failures and successes in these three situations.

8.2.1 SOC and DOC Search Failures for the Same Topic

In table 50, the reasons for the failure of searches for 17 different search topics are listed. Since both SOC and DOC were searched for a topic, a total of 34 searches failed. This represents only 5% of the total number of searches conducted by library patrons and staff. These 14 failed searches were conducted in the Comparison Search Experiment by library patrons who performed a search of their own choosing. Twelve of the 34 searches failed because the topic searched by the patron was marginal to the subject area of the library's database in the experimental online catalog. Two searches failed because the patron's topic was about current events.

In eight failed searches, the searcher performed a direct (SD) search and entered words that did not match subject heading words. Instead, the user-entered term matched words from other subject-rich fields of bibliographic records causing the retrieval of false drops (i.e., nonrelevant items). Such a failure demonstrates that it is important for searchers to enter words in relevant subject headings when they perform Boolean-based, keyword searches in online catalogs.

Two searches in SOC and one search each in SOC and DOC failed because the user did not display a sufficient number of bibliographic records in a retrieved set of items to find relevant items. Other reasons for and explanations of search failures in SOC and DOC are covered in sections 8.3-8.6 which address the different subject search options of the experimental online catalog.

Table 50. Reasons for Failure of SOC and DOC Searches for the Same Topic

Option	Explanation	Number of Searches
SOC and DOC Search Failures (Same Reasons for Failure in SOC and DOC Searches):		
None	Marginal topic in this database	12
SD	User-entered term was not made up of relevant subject heading words describing the topic	8
None	New topic for this database that was probably covered in journal literature but not books	2
SA and SD	In SOC and DOC, user-entered term matched subject headings and DDC subject information but user couldn't focus on a subtopic of a general topic	2
SD	In SOC and DOC, no items were retrieved for a name of a town and user did not want to broaden topic to find items on the county in which the town was located	2
None	Conflicting relevance assessments for the two searches	2
SD and SL	User displayed too few items (or no) items retrieved in seemingly successful subject searches to find relevant items	2
SOC Search Failures (Different Reasons for Failure in SOC and DOC Searches):		
SA	User-entered term contained one word from a relevant subject heading describing the topic and resulted in many items that user had to scan to find relevant items on a specific aspect of the topic	1
SD and SA	User could not find a relevant subject heading in SOC to describe the topic	1

Table 50. Reasons for Failure of SOC and DOC Searches for the Same Topic (continued)

Option	Explanation	Number of Searches
DOC Search Failures (Different Reasons for Failure in SOC and DOC Searches):		
SS	User was directed to a general class area even though there was a specific class area for items on the topic, since the library does not use specific numbers	1
SL	Enhancement of bibliographic records with DDC subject information matched user-entered term and directed user to a relevant class number area, but user displayed too few items to find relevant items	1

8.2.2 SOC Search Failures for a Topic

In the second situation in which users' searches failed, a SOC search for a topic failed and a DOC search for the same topic succeeded. In table 51, the reasons for the failure of 17 searches to retrieve relevant items in SOC are listed. These 17 searches are 5% of the total number of searches conducted in SOC by staff and patrons. The reason for failure that occurred most frequently was the searchers' failure to display a sufficient number of items in a set of items that appeared to be relevant items. In three direct (SD) searches, users entered terms that were not comprised of words in relevant subject headings. These two reasons were also cited as a frequent reason for failure in SOC and DOC searches for the same topic (table 50). In two searches, users entered a term that was not made up of subject heading words and failed to retrieve items in direct (SD) and alphabetical (SA) searches.

Following the reasons why SOC searches failed are listed the reasons why DOC searches for the same topic succeeded. A number of DOC searches succeeded because users selected a relevant Relative Index entry that led directly to the display of relevant items. Another reason for success in DOC searches was the users' entry of a term in direct (SD) searches that contained words from a relevant subject heading describing the topic. The success of three DOC searches was attributed to the enhancement of bibliographic records with DDC information that matched the user-entered term and directed the user to a relevant class number area in a subject outline (SS) search or to bibliographic records in a direct (SD) search. Other reasons for and detailed explanations of search failures and successes are covered in sections 8.3-8.6, which address the different subject search options of the experimental online catalog.

Table 51. Reasons for Failure of SOC Searches

Option	Explanation	Number of Searches
SOC Search Failures:		
SL	User displayed too few (or no) items retrieved in seemingly successful subject searches to find relevant items	4
SD	User-entered term was not made up of relevant subject heading words describing the topic	3
SD and SA	User-entered term was not made up of relevant subject heading words or the first word of a relevant subject heading	2
SA and SD	User could not find the correct subject heading or subject heading words in SOC relevant to the topic	2
SA	User needed to browse backwards in list of subject headings to find a relevant subject heading describing the topic	1
SA	User could not find the correct subject heading in LCSH to describe the topic	1
SA	User could not find a relevant subject heading subdivision in SOC to describe the topic	1
SA	Incorrect entry of punctuation in a user-entered term resulted in display of subject headings that were not in the alphabetical neighborhood of relevant subject headings describing the topic	1
SD and SA	User-entered term described a topic more general than the user's actual query and did not direct the user to topics more specific than the general topic	1
None	Conflicting relevance assessments for the two searches	1

Table 51. Reasons for Failure of SOC Searches (continued)

Option	Explanation	Number of Searches
DOC Search Successes:		
SA	User selected a Relative Index entry that led him to relevant items in a classification area	6
SD	User-entered term contained words from a relevant subject heading describing the topic	4
SS	Enhancement of bibliographic records with DDC subject information matched user-entered term and directed user to a relevant class number area	2
SD	Enhancement of bibliographic records with DDC subject information matched the user-entered term	1
SD	User-entered term contained words that were from a relevant subject heading found in LCSH describing the topic	1
SA	User selected a Relative Index entry that led him to a classification area and more specific class areas in which relevant items were found	1
None	Conflicting relevance assessments for the two searches	1
SD	User-entered term directed user to relevant items whose words in various subject-rich fields matched the user-entered term	1

8.2.3 DOC Search Failures for a Topic

The third situation in which users' searches failed was when a DOC search for a topic failed and a SOC search for the same topic succeeded. In table 52, the reasons for the failure of 31 searches to retrieve relevant items in DOC are listed. These 31 searches are 9% of the total number of searches conducted in DOC by staff and patrons. The reason for failure that occurred most frequently was the searchers' failure to display a sufficient number of items in a set of items that appeared to be relevant items. This reason was also cited as a frequent reason for failure in SOC and DOC searches for the same topic (table 50), and in SOC searches (table 51). Other reasons for frequent DOC search failures had to do with subject outline (SS) searches. In these subject outline searches, users were directed to a general class area that they wanted to limit to express a more specific topic or the second facet of a multifaceted search topic. Another reason for subject outline (SS) search failures was that the user was directed to a broad and highly posted class number area because the user-entered term matched the first-listed subject heading of two or more items bearing the same three-digit class number but not the same specific class number. Other reasons for failure of subject outline (SS) searches are discussed in greater detail in section 8.4.

DOC's alphabetical (SA) search was responsible for the failure of five searches because the searcher was unable to find a suitable Relative Index entry to describe the topic; two of these five searches failed because the user failed to find a Relative Index entry and failed to find a suitable classification area in a subject outline (SS) search or relevant items in a direct (SD) search.

Table 52 also includes a list of the reasons why SOC searches succeeded for the same topic that a DOC search failed. Nine SOC searches were successful because the user found a relevant subject heading(s) and subdivision(s) in an alphabetical search. In five SOC searches, users found a relevant main subject heading in alphabetical (SA) searches. Another frequent reason for success in SOC searches was the retrieval and display of relevant items based on matching relevant subject heading words with the user-entered term in direct (SD) searches. Other reasons for and detailed explanations of search failures and successes are covered in sections 8.3-8.6, which address the different subject search options in the experimental online catalog.

Table 52. Reasons for Failure of DOC Searches

Option	Explanation	Number of Searches
DOC Search Failures:		
SL	User displayed too few (or no) items retrieved in seemingly successful subject searches to find relevant items	5
SS	User-entered term directed user to a broad and highly posted class number area that the user wanted to limit to a more specific topic of the broad topic of the class number area	4
SS	User-entered term directed user to a highly posted class number area that the user wanted to limit to express the second facet of his topic	4
SA	User-entered term did not match the first word(s) of a relevant Relative Index entry	3
SS	The specific words in a user-entered term directed user to a broad and highly posted class number area because indexed, first-listed subject headings were contained in items classed in two or more specific class number areas	3
SD and SS	User-entered term was not made up of relevant subject heading words describing the topic	2

Table 52. Reasons for Failure of DOC Searches (continued)

Option	Explanation	Number of Searches
DOC Search Failures:		
SS and SA	User-entered term did not direct user to any classification area or to a suitable Relative Index entry on the topic	1
SS and SA	User-entered term did not direct user to a classification area or to a subject Relative Index entry on the topic which described a geographical area of interest	1
SS	User-entered term was a broad topic and led user to highly posted and general class areas which user did not pursue by browsing specific topics	1
SS and SL	User-entered term directed user to a relevant class number area, but user did not display items because Schedule caption did not specifically describe his topic	1
SD	When subject outline (SS) and direct (SD) searches resulted in zero items, user entered a broad term to express one of the facets of a multifaceted query	1
None	User seemed to change his topic in the middle of the search	1
SS	User-entered term matched words in a Relative Index entry and Schedule caption bearing different specific class numbers, so user was directed to a broad and highly posted classification area	1
SS	Incorrect entry of punctuation in user-entered term resulted in zero items	1
SS	User-entered term directed user to a highly posted class area where items on the specific topic and many other topics were classed	1
SS and SL	User-entered term directed user to a relevant class number area. Because the geographic area of the topic was expressed by a built class number, the relevant items on this topic were the last four items in a set of 15 items, and the user displayed too few items to find these relevant items	1

Table 52. Reasons for Failure of DOC Searches (continued)

Option	Explanation	Number of Searches
SOC Search Successes:		
SA	User-entered term directed user to a display of relevant subject headings and subdivisions and to relevant items	9
SD	User-entered term contained words from a relevant subject heading describing the topic	6
SA	User-entered term directed user to a display of relevant subject headings whose first word(s) matched the first word in the user-entered term and to relevant items	5
SD	User-entered term directed user to relevant items whose words in the various subject-rich fields matched the user-entered term	4
SL	User displayed more items in the SOC search using the same search option(s) than in the DOC search for the same topic	3
SD and SA	User-entered term was made up of relevant subject heading words describing the topic or the first word(s) of such a heading	2
SD	User-entered term was made up of relevant subject heading words and resulted in a set of items, a dozen of which the user scanned to find mention of the second facet of a multifaceted topic	1
SA	User-entered term contained words that were from a relevant subject heading found in LCSH describing the topic	1

8.2.4 Percentages of Successful and Failed SOC and DOC Searches

In table 53, the number and percentages of successful and unsuccessful subject searches in SOC and DOC by library patrons and staff are summarized. In general, 90% of searches conducted by library patrons and staff in SOC were successful. Five percent of their SOC searches were unsuccessful but were successful in a DOC subject search for the same topic and vice versa. Seven percent of patrons' searches were unsuccessful in both SOC and DOC searches for the same topic; however, over half of these unsuccessful patron searches were collection failures. Twelve percent of patrons' searches in DOC were unsuccessful and 7% of staff searches in DOC were unsuccessful. Only 3% of staff subject searches did not result in the retrieval and display of relevant items in both SOC and DOC searches for the same topic.

Overall, library patrons and staff retrieved and displayed relevant items in 86% of DOC searches and were unsuccessful in 9% of DOC searches. Only 5% of subject searches did not result in the retrieval and display of relevant items in both SOC and DOC, i.e., the combined subject searching capabilities of both catalogs were ineffective in retrieving relevant items on the same topic.

The success rate of library patrons and staff in retrieving and displaying relevant items in SOC and DOC subject searches was very similar. To achieve the best results in subject searches, the combined subject searching capabilities of SOC and DOC should be incorporated into online catalogs. However, SOC or DOC alone is capable of directing users to relevant items on a topic and the success rates of library patrons and staff in retrieving and displaying relevant items are virtually the same in both catalogs.

The statistics in table 53 and the reasons for failure and success in SOC and DOC in tables 50-52 summarize failed searches in which no relevant items were retrieved or displayed. Yet, there were many searches in SOC and DOC in which searchers entered one or more access points into the catalog that failed to result in retrieval and display of relevant (or any) items for the same reasons as listed in tables 50-52. In sections 8.3-8.6, we will take a closer look at the reasons for the success and failure of the different subject searching capabilities of SOC and DOC with a view of improving the design of these capabilities and of the integration of a library classification into the subject searching capabilities of online catalogs.

Table 53. Percentages of Successful and Unsuccessful SOC and DOC Searches

	%Patron Searches	%Staff Searches	%Total
SOC Searches for a Topic:			
Successful searches for a topic	89	91	90
Unsuccessful searches for a topic	4	6	5
Unsuccessful searches for the same topic	7	3	5
Number of SOC Searches =	162	180	342
DOC Searches for a Topic:			
Successful searches for a topic	81	90	86
Unsuccessful searches for a topic	12	7	9
Unsuccessful searches for the same topic	7	3	5
Number of DOC searches =	158	180	338

8.3 Direct Searches

8.3.1 Introduction

The direct (SD) search in SOC and DOC is a keyword and implicit Boolean search using the AND operator. In a direct search in SOC, a user-entered term retrieves items whose title, subject heading, sponsor, series, and selected note fields contain all of the words in the user-entered term. In a direct search in DOC, a user-entered term retrieves items whose title, subject heading, sponsor, series, selected note, Dewey subject, Dewey Schedule note, and Dewey Index (i.e., Relative Index entry) fields contain the words in the user-entered term.

Although this subject search option was listed second in the options menu in SOC and third in the options menu in DOC, the direct search was the most frequently used subject search option of all three such options in SOC and of all four such options in DOC. The direct search provided the searcher with the number of items retrieved for the user-entered term and did not require other options besides the option to display the results of this search. It was somewhat simpler to use than the alphabetical (SA) searches in SOC and DOC, the subject outline (SS) search in DOC, and the call (SC) number search in DOC. Conducting these other subject searches often entailed browsing alphabetical or logical lists of terms and selecting a listed term that described the user's topic; this browsing and selecting required the user to choose options besides the subject search option. In practice, the direct search was rather easy for searchers to use to retrieve items in a topic. The searcher merely typed a term into the catalog and the system responded with the number of items bearing the user-entered term in any of the subject-rich fields searched by SOC or DOC in the direct search. If items were retrieved, the searcher then had the option to display these retrieved items or to start the search over.

8.3.2 Retrieving Relevant Items in Direct Searches

Table 54 includes numbers and percentages showing how often SOC and DOC users were successful retrieving and displaying relevant items. The information in table 54 was extracted from table 48 to highlight the performance of the direct search. The percentage of times that the SD option led searchers to relevant items was greater in DOC than in SOC in retrieval tests with patrons and staff at most participating libraries. Furthermore, the percentage of times that no items were retrieved in direct searches was greater in SOC than in DOC. Direct searches in DOC were enhanced with the DDC, whereas direct searches in SOC were not enhanced with such subject-rich information. Thus, the results about retrieving relevant items and zero items in direct searches are evidence that the enhancement of bibliographic records with DDC benefited users in their subject searches by directing them to relevant items with greater frequency in DOC than SOC and retrieving zero items with lesser frequency in DOC than SOC.

Table 54. Direct Searches Directing Users to Relevant Items

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
1. Patrons' selection of the SD (direct search) option										
a. Selected	116	90	97	75	80	57	78	50	371	272
b. Relevant items	36	34	40	28	26	27	28	23	130	112
c. Percentage of times SD option led directly to relevant items	31%	38%	41%	37%	33%	43%	36%	46%	35%	41%
d. Percentage of times zero items retrieved	35%	27%	41%	40%	33%	23%	23%	34%	34%	31%
2. Staff selection of the SD (direct search) option										
a. Selected	56	57	77	75	77	49	74	54	284	235
b. Relevant items	37	39	28	28	36	34	38	39	139	140
c. Percentage of times SD option led directly to relevant items	66%	68%	36%	37%	47%	69%	51%	72%	49%	60%
d. Percentage of times zero items retrieved	11%	5%	34%	23%	22%	16%	14%	6%	21%	13%

8.3.3 Recall and Precision of Direct Searches

The success of the direct search in DOC was also apparent in the estimated recall scores of subject searches in which the searcher(s) who performed a search for the same topic used the direct search in both SOC and DOC searches. Average estimated recall scores are listed in table 55 for only those searches in which the searcher(s) who performed a search for the same topic used the direct search in both SOC and DOC searches. Estimated recall of patron and staff searches in DOC exceeded estimated recall of patron and staff searches in SOC at LC and PLCFC, and estimated recall of staff searches in DOC exceeded estimated recall of staff searches in SOC at UI. The precision of patrons' searches was greater in direct searches in SOC than in DOC, and the precision of staff searches was equal or almost equal in direct searches in SOC and DOC (except at LC, where precision of direct searches in DOC exceeded the precision of direct searches in SOC).

Analyses of variance were conducted on direct searches in SOC and DOC using recall and precision as dependent measures. Separate analyses were performed for patron and staff searches. The design of the analysis was similar to the design described in chapter 6 (see fig. 41). In the analysis of patron searches, there were no significant effects for library and system factors and for their interaction on recall and precision. In the analysis of staff searches, there were no significant effects for the library and system factors on precision and for their interaction on precision. However, a marginally significant effect was found when the recall of staff searches was analyzed. The effect was due to the system factor (F = 3.92, p = 0.0504). The estimated recall scores in table 55 show that recall of direct searches by staff in DOC exceeded recall of direct searches in SOC at three of the four participating libraries. These statistics on estimated recall and precision are different from the overall statistics of SOC and DOC searches without reference to particular subject searches (see tables 29, 36, 42, and 45). The overall statistics in these four tables contained significant system effects in analyses of recall and precision, whereas statistics based on direct searches did not contain any significant system effects, except for the marginally significant effect when the recall of staff searches was analyzed. This suggests that the performance of the direct searches in SOC and DOC are comparable.

The percentages of matched relevant items that were retrieved and displayed in direct searches in SOC and DOC show that just about half of these relevant items were retrieved in one system and not in the other. That is, one of every two items retrieved and displayed in a DOC direct search by a patron was also retrieved in a direct search for the same topic in SOC. Four of every seven items retrieved and displayed in a DOC direct search by staff members were also retrieved in a direct search for the same topic in SOC.

Table 55. Estimated Recall and Precision Scores of Users' Direct Searches

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
1. Estimated recall in patron searches										
a. Recall scores	70%	78%	80%	61%	56%	66%	69%	63%	70%	66%
b. Combined total number of relevant items retrieved and displayed	64		117		96		64		341	
c. Number of relevant items retrieved and displayed	45	50	94	71	54	63	44	40	237	224
2. Estimated recall in staff searches										
a. Recall scores	59%	68%	64%	60%	65%	74%	56%	84%	61%	72%
b. Combined total number of relevant items retrieved and displayed	126		123		159		146		554	
c. Number of relevant items retrieved and displayed	74	86	79	74	103	117	82	123	338	400

Table 55. Estimated Recall and Precision Scores of Users' Direct Searches (continued)

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
3. Precision in patron searches										
a. Patron searches	27%	21%	51%	36%	51%	44%	46%	35%	43%	32%
b. Number of items retrieved and displayed	166	239	186	197	106	144	95	113	553	693
4. Precision in staff searches										
a. Precision scores	49%	75%	56%	54%	75%	75%	63%	59%	60%	65%
b. Number of items retrieved and displayed	151	114	142	138	137	157	131	207	561	616
5. Percentage of matched relevant items retrieved and displayed in SOC and DOC direct searches										
a. Patron searches	47%	42%	52%	69%	44%	38%	43%	48%	48%	50%
b. Staff searches	58%	50%	57%	61%	67%	59%	85%	57%	67%	57%

8.3.4 Successful Direct Searches

The reasons for searchers' success and failures in SOC and DOC are listed in tables 51 and 52. Four searches in SOC failed for various reasons but succeeded in direct searches in DOC because the user-entered term in the DOC search contained words from a relevant subject heading describing the topic (see table 51). In one direct search in DOC, the user first consulted the printed LCSH for the correct subject heading and then expressed his topic in a direct search using this subject heading. Here are some examples:

Expressed Topic	Direct Search Access Point	Correct Subject Heading
Industry surveys	market surveys united states	Market surveys--United States
Uses of microcomputers in business	industrial management data processing	Industrial management--Data processing
History of the New York State capitol building	new york state capital and capitol	New York (State)--Capital and capitol
Integral geometry	integral geometry	Geometry, Integral
Role of New York (State) in the American Revolution	new york state history revolution	New York (State)--History--Revolution, 1775-1783

Likewise, nine searches in DOC failed for various reasons but succeeded in direct searches in SOC because the user-entered term in the SOC search contained words from a relevant subject heading describing the topic (see table 52). Examples of such access points and subject headings in SOC searches are:

Expressed Topic	Direct Search Access Point	Correct Subject Heading
Job hunting	job hunting	Job hunting
Glens Falls	glens falls	Glens Falls, N.Y.
Civil War	civil war	United States--History--Civil War, 1861-1865, or New York (State)--History--Civil War, 1861-1865
Fort Niagara	fort niagara	Fort Niagara, N.Y.
Steuben County, NY	steuben county	Steuben County, N.Y.
Poughkeepsie	poughkeepsie	Poughkeepsie, N.Y.
Traveling on the St. Lawrence River	lawrence river travel	St. Lawrence River--Description and travel
Boys' gymnastics	gymnastics	Gymnastics
Hyperbolic equations	hyperbolic equations	Differential equations, Hyperbolic

Access points in direct searches composed of words from relevant subject headings that described the user's topic of interest were an effective way of retrieving relevant items. However, users did not always know the subject heading that best described their topic, nor did they bother to check the printed LCSH to find an appropriate heading. Instead, searchers expressed their topics of interest in a user-entered term in SOC or DOC direct searches that they felt best described their topic of interest. The best result of such direct searches was the retrieval of relevant items whose subject-rich fields contained the user-entered term in one or more subject-rich fields of the item, e.g., title, subject heading, Relative Index entry (DOC only) fields. One DOC search and four SOC searches failed for various reasons but succeeded in direct searches because the user-entered term directed the user to relevant items whose words in various subject-rich fields matched the user-entered term. Here are some examples:

Expressed Topic	Direct Search Access Point
Silver trade	silver
Revolutionary War in New York State	new york state in revolutionary war
Television commercials	television commercials
Textbooks in advanced calculus	advanced calculus
Food problems in third world countries, especially in Africa	food problems

8.3.5 System Feedback in Direct Searches

When such direct searches resulted in the retrieval of relevant items, there was often one or more subject headings in retrieved, relevant items that, if entered into the system in another search, could have led to the retrieval of additional relevant items. For example, a patron whose expressed topic was "French government: national trade and monetary policy" entered the phrase "french economy" into DOC, which retrieved one relevant item entitled *The French economy* that bore two subject headings: "France--Economic conditions--1945-" and "France--Economic policy--1945-." If the searcher had entered the latter into DOC using the direct search, he would have retrieved an additional 11 items bearing titles such as *Public assistance to industries and trade policy in France*, *The politics of economic policy, France 1974-1982*, and *Economic policies in France, 1974-1982*, which might have been relevant to the user's topic of interest. Other examples are provided in table 56.

Table 56. Relevant Subject Headings and Titles Retrieved in Direct Searches

Expressed Topic	Direct Search Access Point	Number of Items Retrieved	Relevant Subject Heading	Number of Additional Items Retrieved
1. Incompleteness theorem	incompleteness theorem	1	Incompleteness theorems	1
Additional title retrieved: *Formal number theory and computability*				
2. Stage movement	stage movement	4	Movement (Acting)	7
Examples of additional titles retrieved: *A movement approach to acting*; *Theatre movement: the actor and his space*; and *Movement for the performing artist*				
3. Aerobics	aerobics	1	Aerobic exercises	6
Examples of additional titles retrieved: *Aerobic dance and fitness*; *Aerobic weight training*; *Aerobic tennis*; *Aerobic dancing*; and *Dance aerobics*				
4. New Netherlands	new netherlands	15	New York (State)--History--Colonial period, ca. 1600-1775	over 100
Examples of additional titles retrieved: *Henry Hudson and the Dutch in New York*; *History of New Netherland, or New York under the Dutch*; *The patroon's domain*; *Portrait of New Netherland*; *New York historical manuscripts: Dutch*; and *A sweet and alien land: the story of Dutch New York*				
5. Analytical geometry	analytical geometry	30	Geometry, Analytic	344
Examples of additional titles retrieved: *Freshman mathematics, a course in the essentials of algebra, trigonometry and analytic geometry*; *New analytic geometry*; *Analytic geometry and calculus*; and *A first course in analytic geometry*				

Unfortunately, most online catalog searchers do not know that it is useful to check the subject heading field of retrieved, relevant records to find subject heading(s) relevant to their topic of interest in order to enter the heading(s) into the online catalog to find additional relevant items. When users display bibliographic records in online catalog subject searches, the catalog should occasionally remind the user to check the subject headings in retrieved records to enter later in the search. An alternative to this approach is an online catalog capability, which has already been implemented in three online catalogs--NLS of the University of Wisconsin at Madison, LIAS at Pennsylvania State University, and the turnkey online catalog of Dynix--that allows users to select a subject heading from retrieved items to find additional items bearing the selected heading. The Tinman online catalog features a comparable capability as the NLS, LIAS, and Dynix online catalogs. Tinman does not restrict users to the selection of subject headings, but allows them to select terms from any field in bibliographic records (personal communication with Charles R. Hildreth, 1985 October).

8.3.6 Unsuccessful Direct Searches

Many users' direct searches failed to retrieve relevant (or any) items because the user-entered term was not made up of relevant subject heading words describing their topic of interest. Often, users would display a half-dozen or so retrieved items and stop displaying them because no relevant items had yet been displayed. Here are some examples:

Expressed Topic	Direct Search Access Point (Number of Items Retrieved)
Conducting successful business meetings	personnel meetings (0)
Descriptive statistics	descriptive (185)
How to invest in the stock market	how to invest in the stock market (0)
Photographs or sketches of the Hudson River (from 1850-1910)	hudson river photography (0) hudson river sketches (37) hudson river description and travel (99)
Bohemian life in Greenwich Village	bohemian york (0)
Game hunting without guns	hunting implement (7) primitive hunting (0)
Improving your golf swing	golf instruction (0) improving your golf swing (0)
General Montcalm (of New France)	general montcalm (2)
19th century experiences traveling on New York State's canals	canals (11) new york canals description and travel 19th century (0)
Current guide-books on what to do or see in New York (City)	contemporary new york city travel (1)
Black history of Albany, N.Y.	african-american history in new york state (0)

Such direct searches must have been frustrating to searchers, particularly those searches in which no items were retrieved. A number of searchers continued their search by entering an access point that was a broader term than one previously entered. Here are some examples:

Expressed Topic	Direct Search Access Point
Black History of Albany, N.Y.	afro-american (5)
General Montcalm (of New France)	new france (41)
Bohemian life in Greenwich village	york city (1640) york customs (151)
Current guide-books on what to do or see in New York (City)	new york state travel (825) new york city (900)
Descriptive statistics	statistics (234)
How to invest in the stock market	investment (272)
Improving your golf swing	golf (223)

These broader terms entered by users were either complete subject headings, i.e., new york city, statistics, and golf, or parts of subject headings, i.e., afro-americans, york city, investment, new york state travel, york customs, and see references to valid subject headings, i.e., new france. Most of the time, the user was overwhelmed by the number of items retrieved and did not display retrieved items. Had users consulted the printed *LCSH* under two of the complete subject headings, they would have been directed to the appropriate subject heading "Swing (Golf)," which is a see also reference under "Golf," and to the appropriate subject heading "New York (City)--Description--Guide-books," which is a suggested subdivision under New York (City). The searchers in these two searches did not consult the printed *LCSH*, and subject searches for these two topics failed to retrieve relevant items in both SOC and DOC.

The major reason why patron and staff direct searches failed to retrieve relevant (or any) items is because their user-entered terms in direct searches were not composed of words from relevant subject headings describing their topics of interest. Another reason for the failure of direct searches was the tendency of this subject search option to misguide users by directing them to a classification (or bookshelf) area where a number of books on a particular topic were located based on the retrieval and display of a half-dozen or so relevant items when in fact the area was not good for bookshelf browsing. For example, a direct search on "Combinatorial analysis" in DOC results in the retrieval of 35 items. The first six items bear the class number 510 because they are collections or conference proceedings on this topic, e.g., *Theory and practice of combinatorics: a collection of articles honoring Anton Kotzig...*, *Bonn Workshop on combinatorial optimization*, and *Studies in pure mathematics; papers in combinatorial theory.* A user who displays these first six items would probably be tempted to browse the shelves at the class number 510; however, 27 of the 35 items are classed in 511.6 and this class number area is probably the most fruitful area for shelf browsing. Another example is a direct search for "Leadership." The first six of 22 items displayed in a direct search in DOC are scattered into five different class areas and are about leadership of trade unions and leadership in a specific industry, trade, or profession. The last 7 of 22 items are classed in 658.409 and more specific class numbers and are about leadership in business management. Thus, a searcher interested in the latter topic would find items on this topic if he persevered and displayed more than the first 10 items or used DOC's subject outline search for this topic.

The solution to this problem in direct searches is to alter the display of retrieved items so that items in the highest posted class area are displayed first. Reversing the display of retrieved items is not an adequate solution because high-posted class areas for the user-entered term may be at the beginning of the classification. Another solution is DOC's subject outline (SS) search which is intended to direct users to the most fruitful class area(s) for shelf browsing. Had the user entered "Combinatorial analysis" into DOC using the subject outline search, DOC would have directed the user to the class number 511.6 and the 22 items bearing that class number.

In DOC, bibliographic records were enhanced with subject-rich information from the DDC Schedules and Relative Index. Sometimes this enhancement led to the retrieval of relevant items on a topic, and sometimes it resulted in the retrieval of many items. One example of the former result is the direct search for "third world economics." In SOC, a direct search for "third world economics" retrieves two relevant items entitled Economics of the third world and Monetarism, economic crisis, and the third world. These two items were retrieved because their title, subject heading, sponsor, and selected note fields contained the user-entered term. In DOC, a direct search for "third world economics" retrieves these same two relevant items and 22 additional items with titles and class numbers such as The EEC (European Economic Community) and the third world (337.4), The international economy and industrial development: the impact of trade and investment on the third world (338.09), and The third world, premises of U.S. policy (337.7). The major reason why these additional titles were retrieved is the enhancement of these items with the term "economics" from DOC Schedule captions or Relative Index entries. For example, the item entitled "The EEC and the third world" was enhanced with the Schedule captions "International economics" and "Foreign economic policies and relations of specific jurisdictions and groups of jurisdictions" and the Relative Index entry "Foreign--economic problems--international economics." Because this item did not bear the term "economics" in SOC, it was not retrieved in a direct search for "third world economics." After this item was enhanced with the DDC, it contained the term "economics" and was retrieved in a direct search in DOC. Searches for the two topics "Descriptive statistics" and "Probabilistic processes" succeeded in DOC and failed in SOC; the reason for their success in DOC was the enhancement of bibliographic records with subject-rich information from the DDC.

Such enhancement of bibliographic records did not always provide beneficial results. In a SOC search for "Linear algebra," 46 items were retrieved, the majority of which were classed in 512.5 and assigned the LC subject heading "Algebras, Linear." A DOC search for "linear algebra" retrieved 616 items. Of these 616 items, the 45 items bearing the class number 512.5 were probably relevant to the topic "Linear algebra," since this class number category bears the Schedule caption "Linear, multilinear, multidimensional algebras" and Relative Index entry "Linear--algebras." However, many more items were retrieved in the direct search than these 45 items because of the enhancement of bibliographic records with the DDC. The class number, number of items, and reason for retrieving 616 records are provided for this direct search on "Linear algebra":

Class Number	Number of Items	Reason for Retrieval
516.35	443	"Linear algebra" contained in a general Schedule note
512.55	60	"Linear algebra" contained in a class here note from the Schedule
515.14	5	"Linear algebra" contained in the Schedule caption
512.57	5	"Linear algebra" contained in class here note from the Schedule

These reasons for retrieval account for 513 of 616 items in a direct search for "Linear algebra" in DOC. The remaining items were probably retrieved by matching words in the subject-rich fields of the record, i.e., title, subject heading, sponsor, and selected note fields, and words in the subject-rich fields added to the record, i.e., Relative Index, Schedule caption, and Schedule note fields.

A direct search in DOC for the topic "Linear algebra" yields many items (616) in comparison to a SOC search (46). In the online retrieval tests, a total of two DOC searches in the Comparison Search and Sample Search Experiments required the user to enter the term "linear algebra." The staff searcher entered this topic using the direct search; however, this searcher did not pursue this direct search but chose instead to reenter the topic using the call number (SC) search under "512.5," a class number to which he'd been directed earlier in the session using the subject outline (SS) search and the term "linear algebra." Displaying items under the class number 512.5, the searcher judged them relevant. The patron searcher did not use the direct search for the topic "Linear algebra." Like the staff searcher, the patron found relevant items using the subject outline (SS) search for the topic "Linear algebra." Other examples of search topics and direct search access points that were adversely affected by the enhancement of subject information from the DDC are the following:

Expressed Topic	Direct Search Access Point	Number of Items Retrieved in SOC	Number of Items Retrieved in DOC
Proof theory	proof theory	11	79
Vector analysis	vector analysis	26	54
Computer games	computer games	7	257
Derivatives	derivatives	2	409
Photographs or sketches of the Hudson River (from 1850-1910)	hudson river	112	1086

Subject searches in DOC were successful for four of the five searches above. Only the search for "Photographs and sketches of the Hudson River (from 1850-1910)" failed. Subject searches for the four other topics yielded relevant items through subject searches other than the direct search, particularly the alphabetical (SA) or subject outline (SS) search. These subject search options directed searchers to a class area in which they scanned retrieved items for relevant ones. The "Hudson River" search failed because alphabetical and subject outline searches in DOC did not direct searchers to a relevant class area for reasons that are unique to these two subject search capabilities and are discussed in section 8.4 (subject outline searches) and 8.5 (alphabetical searches). In SOC, the searcher was directed to relevant items on the "Hudson river sketches" topic because he had the advantage of browsing an alphabetically arranged list of subject headings and subdivisions beginning with the main heading "Hudson River."

8.3.7 Searchers' Experiences Using Direct Searches

In the post-search interview, the majority of library patrons and staff singled out direct search as the online catalog capability that was most helpful for directing them to relevant items on a topic. Their comments about direct searching are the following:

- I like the direct search because it is quick and pinpoints relevant items. (six staff, PLCFC; two staff, UI; one staff, LC)
- The direct search pinpoints relevant items and you can enter more than one term into the catalog. (two staff, PLCFC)
- I like retrieving items right away with a minimum of time and effort using the direct search. (two staff, NYSL; one patron, UI)
- In SOC and DOC, the direct search obtains the best results. Why should I need the other subject search options? (one staff, NYSL)
- I liked the direct search because it saved me from having to know all the subject headings describing my topic. (four staff, UI)
- List the direct search first because it is more likely (than other options) to lead you to relevant items. (one staff, PLCFC; two staff, UI)

A number of patrons and staff noted the direct search's report of successive postings, which helped them to identify words that were contained in few or no items, and later omitted these words from the user-entered term in subsequent searches. For example, a patron entered the term "implicit differentiation" into SOC and the system reported that one item was retrieved for "implicit," three items were retrieved for "differentiation," and zero items were retrieved for "implicit differentiation." Then, the searcher entered the term "implicit" in a direct search and retrieved one relevant item entitled Constrained equations in a study of implicit differential equations and their discontinuous solutions.

Not all searchers' remarks about direct searches were favorable. Their unfavorable remarks note their dissatisfaction with the direct search's inability to provide feedback about searchable terms and with their inability to alter the results of a direct search:

- I want to limit the results of a direct search without having to start over. (one patron, NYSL)

- With the direct search, it was difficult to limit the search. Sometimes thumbing through books is the only way to find relevant items. (one patron, LC)
- If you hit your topic using the direct search, you don't get a chance to see how your topic is organized or what you didn't retrieve using other search options. (one staff, LC)
- Using the direct search, your subject is either in the catalog or not in the catalog. When it's in the catalog, this option performs well. (one staff, LC)
- Using the direct search in SOC and DOC, you have to know the right words to find relevant items. When you find the right words, the direct search works well. (one staff, NYSL)
- The direct search gives no assistance for finding related terms. (one staff, UI)

8.3.8 Summary

The percentage of times that DOC's direct search retrieved relevant items for a user's topic of interest was greater than the percentage of times that SOC's direct search retrieved relevant items. The percentage of times that no items were retrieved in direct searches in SOC was greater than the percentage of times that no items were retrieved in direct searches in DOC (table 54). These results about relevant items and no retrievals are evidence that the enhancement of bibliographic records with the DDC improved subject access in DOC's direct searches.

The direct search was particularly effective in retrieving relevant items on a topic when the user-entered term matched words in a relevant subject heading. When the user-entered term was not composed of words from relevant subject headings, it sometimes retrieved relevant items (section 8.3.4). Access points in direct searches that were not composed of words from subject headings and led users to no retrievals or the retrieval of nonrelevant items provided them with little feedback about indexed terms in the online catalog except through the report of successive postings that told the number of items retrieved per word of the user-entered term.

A few users noted relevant subject headings in retrieved, relevant items in direct searches and entered these headings into the catalog using a direct or other subject search. Examples of retrieved, relevant items for certain topics were shown in which the subject heading(s) found in one relevant item could be used to find additional relevant items. Some online catalogs are now equipped with a capability for searchers to select a subject heading (or some other criterion) in a retrieved item to find additional items bearing the selected heading (section 8.3.5). The experimental online catalog did not feature such a capability. So, users whose direct searches resulted in no retrievals sometimes continued their search by entering an access point that was broader than their expressed topic and resulted in many retrievals, i.e., over 200 (section 8.3.6).

In general, there was no difference between direct searches in SOC and DOC with regard to estimated recall and precision. However, there was a marginally significant effect in the estimated recall of staff searches, and the recall scores of staff searches in DOC at three of the four participating libraries exceeded the recall of staff searches in SOC (section 8.3.3). The performance of direct searches in the two systems are comparable, but about half of the relevant items retrieved and displayed in direct searches in DOC were unique with respect to the relevant items retrieved and displayed in SOC direct searches.

The percentage of access points in direct searches that resulted in no retrievals was greater in SOC than in DOC. Bibliographic records in the latter had been enhanced with subject information from the DDC. There were times when this enhancement helped users find relevant items on a topic by providing them with additional subject-rich words in items with which to match their terms. Sometimes this enhancement did not help users find relevant items and only contributed to producing searches with a large number of postings and false drops. Most searchers were able to circumvent such results by using a different search option in DOC, but one searcher needed the alphabetical list of subject headings in SOC to focus on the topic and was unable to find relevant items in the DOC search (section 8.3.6).

Another reason for failure in direct searches in SOC or DOC was the tendency of this search to misguide users by directing them to a classification or bookshelf area where a number of books on a particular topic were located based on the retrieval or display of a half-dozen or so relevant items. In DOC, the subject outline (SS) search is intended to direct users to the most fruitful class area for shelf browsing for a topic and its success is featured in the next section.

8.4 Subject Outline Searches

8.4.1 Introduction

Successful subject outline searches directed users to the specific classification area(s) where there were items whose bibliographic records matched the user-entered term. Users did not have to enter class numbers in subject outline searches. Instead, they entered words describing their topic of interest. The subject outline search was unique to DOC and had no counterpart in SOC.

There were two different implementations of the subject outline search. In the Dewey Online Catalog (DOC) developed for the University of Illinois, the searchable index for the subject outline search was made up of words from the DDC Schedules, i.e., Schedule captions, including notes, class here notes, example notes, and general notes, and from the DDC Relative Index. In addition to words from these sources, the Dewey Online Catalog developed for the Library of Congress, New York State Library, and Public Library of Columbus and Franklin County contained words from the first-listed subject heading field of bibliographic records. We wanted to include the first-listed subject heading in the DOC index for the subject outline search at UI to increase the user's chances of matching his term with the subject outline index. There was not enough time available, however, to reindex and test the DOC system for the University of Illinois and keep to our data collection schedule. Thus, DOC indexes for the subject outline search at UI did not contain the first-listed subject heading.

The ability of the subject outline search to direct users to relevant items was not wholly dependent on the system's matching of the user-entered term with the contents of the subject outline index and the system's presentation of a result, i.e., an intermediate result that was a List of Perspectives, or an end result that was a List of Topics (Schedule captions, class numbers, and number of items retrieved per class number and caption). In the user's search for relevant items, he could manipulate the intermediate and end results of subject searches in a number of ways:

- Browsing a listed perspective (BP option)
- Selecting a listed Schedule caption to retrieve and display items (SL option)
- Browsing Schedule captions more specific than a listed caption (BS option)
- Browsing Schedule captions more general than listed captions (BG option)
- Scanning subject-rich information from the DDC Schedules and Relative Index for a listed caption (GN option)

8.4.2 Retrieving Relevant Items in Subject Outline Searches

Tables 57 and 58 show in numbers and percentages how often DOC searchers were successful retrieving and displaying relevant items in subject outline searches conducted by patrons and staff, respectively. Since this subject search option was dependent on other DOC options for directing users to relevant items, these options are also listed in these two tables.

The percentages of times that subject outline searches led directly to relevant items without the use of supporting options was quite low and ranged from 2% of staff and patrons' subject outline searches at NYSL and PLCFC, respectively, to 22% of staff subject outline searches at PLCFC. Subject outline searches at UI always resulted in the intermediate List of Perspectives regardless of the retrieval of items in one or more classification areas. This was changed in the Dewey Online Catalogs for LC, NYSL, and PLCFC so that subject outline searches in DOC at these three libraries did not result in the List of Perspectives when items in only one classification area were retrieved. Instead, such subject outline searches resulted in the List of Topics, i.e., Schedule captions, class numbers, and number of items per caption and class number, in the one specific area of the classification where there were items matching the user-entered term.

Even though UI searchers had to go through at least one more step in subject outline searches than searchers at the other three libraries to obtain the end result of the search, i.e., List of Topics, patron searchers at UI were the most successful searchers in obtaining relevant items for their topics of interest. After PLCFC staff searchers, UI staff searchers were the second most successful searchers in obtaining relevant items for their given topics. However, the largest percentages of subject outline searches resulting in zero items were staff and patron searches at the University of Illinois. Since the index for subject outline searches at UI did not contain words from the first-listed subject heading in bibliographic records, it is not surprising that greater percentages of UI subject outline searches resulted in zero items than such searches at other libraries.

In staff searches, the option to browse general topics (BG) was selected once in conjunction with creating sets of items for display. In patron searches this option was selected only four times, and two of these four times it resulted in the retrieval and display of relevant items. In one of these two searches, the patron was searching for information on the geography of Cayuga County in New York State. The user-entered term "cayuga county new york" directed the user to the class number and Schedule caption "917.4768 Geography of and travel in Cayuga County" and two items. Only one relevant item was retrieved with this class number. As a result, the user selected the option to browse general topics and retrieved 27 items under the class number and Schedule caption "917.476 Geography of and travel in North Central Counties." Of the ten displayed items having this class number, the user judged one item relevant. In the post-search interview, the user remarked, "It seems strange to have to select the option for browsing general topics. You usually want to get more specific." In fact, the option to browse specific topics was selected by library patrons and staff more often than the option to browse general topics and directed these searchers to relevant items about half of the time. A few patrons and one staff member displayed the notes for a DDC Schedule caption and judged these notes relevant to their topic. Since we asked online retrieval test participants to only judge the relevance of bibliographic records, we figured that they considered these Schedule notes like bibliographic records, i.e., the end result of the online search, and would browse the bookshelves for relevant items under the class number in a relevant Schedule note.

Overall, subject outline searches did not direct searchers to relevant items as often as direct searches (see table 54). Subject outline searches conducted by patrons at PLCFC and UI led to relevant items more often than direct searches by patrons at these libraries--but barely. In sections 8.4.3-8.4.8, the reasons why subject outline searches succeeded and failed are described.

Table 57. Subject Outline Searches Directing Patrons to Relevant Items

	LC DOC	NYSL DOC	PLCFC DOC	UI DOC	Total (Four Libraries) DOC
1. Patrons' selection of the subject outline (SS) search option	59	48	44	50	201
a. Relevant items	2	2	1	NA	5
b. Percentage of times SS option led directly to relevant items	3%	4%	2%	NA	3%
c. Percentage of times zero items retrieved	44%	54%	25%	56%	45%
2. Patrons' selection of the browse perspectives (BP) option	18	16	13	21	68
a. Relevant items	0	2	4	8	14
b. Percentage of times BP option led directly to relevant items	0%	13%	31%	38%	21%
3. Patrons' selection of the browse general (BG) topics option	1	1	1	1	4
a. Relevant items	1	1	0	0	2
b. Percentage of times BG option led to relevant items	100%	100%	0%	0%	50%
4. Patrons' selection of the browse specific (BS) topics option	11	7	10	6	34
a. Relevant items	3	2	5	3	13
b. Percentage of times BS option led to relevant items	27%	29%	50%	50%	38%
5. Patrons' selection of the display items (SL) option	10	5	9	11	35
a. Relevant items	2	4	4	9	19
b. Percentage of times SL option led to relevant items	20%	80%	44%	82%	54%
6. Number of times patrons marked the DDC Schedule notes relevant (GN option)	1	0	0	4	5
Percentage of times SS option led to relevant items (directly or through supporting options BP, BG, BS, SL, GN)	15%	23%	32%	48%	29%

Table 58. Subject Outline Searches Directing Staff to Relevant Items

	LC DOC	NYSL DOC	PLCFC DOC	UI DOC	Total (Four Libraries) DOC
1. Staff selection of the subject outline (SS) search option	55	43	36	52	186
a. Relevant items	3	1	8	NA	12
b. Percentage of times SS option led directly to relevant items	5%	2%	22%	NA	6%
c. Percentage of times zero items retrieved	24%	30%	8%	40%	27%
2. Staff selection of the browse perspectives (BP) option	13	17	4	25	59
a. Relevant items	1	2	0	8	11
b. Percentage of times BP option led directly to relevant items	8%	12%	0%	32%	19%
3. Staff selection of the browse general (BG) topics option	0	0	1	0	1
a. Relevant items	0	0	0	0	0
b. Percentage of times BG option led directly to relevant items	0%	0%	0%	0%	0%
4. Staff selection of the browse specific (BS) topics option	6	3	7	5	21
a. Relevant items	2	0	5	5	12
b. Percentage of time BS option led to relevant items	33%	0%	71%	100%	57%
5. Staff selection of the display items (SL) option	6	1	4	7	18
a. Relevant items	2	1	2	2	7
b. Percentage of times SL option led to relevant items	33%	100%	50%	29%	39%
6. Number of times staff marked the DDC Schedule notes relevant (GN option)	0	0	1	0	1
Percentage of times SS option led to relevant items (directly or through supporting options BP, BG, BS, SL, GN)	15%	9%	44%	29%	23%

8.4.3 Successful Subject Outline Searches

Successful subject outline searches are those in which the DOC searcher's entered term matches a Schedule caption, Relative Index entry, or a first-listed subject heading and directs the user to a class number area where the majority of the items classed in that area bear subject headings comparable to the user-entered term. For example, a patron at UI searched for "game theory" using the subject outline search and was directed to the class number and caption "519.3 Game theory" and 32 items. Eleven of the first 15 items displayed contained the subject heading "Game theory." Most of the time, searchers displayed items under a class number when the Schedule caption described their topic of interest. Examples of such successful subject outline searches by the UI staff and patrons are the following:

Expressed Topic/ User-entered Term	Class Number/Schedule Caption	Relevant Subject Heading in Retrieved Items
Series	515.24 Sequences and series	Series
Group theory	515.22 Group theory	Groups, Theory of
Statistics	519.5 Statistical mathematics	Statistical mathematics
Meromorphic functions	515.982 Meromorphic functions	Functions, Meromorphic
Functional analysis	515.7 Functional analysis	Functional analysis

Examples of such successful searches are not as plentiful by LC, PLCFC, and NYSL searchers. The main reason is the inclusion of the first-listed subject heading in the searchable index of the subject outline search which presented a number of problems to otherwise straightforward subject outline searches. Examples of successful subject outline searches in the Dewey Online Catalogs of LC, NYSL, and PLCFC are the following:

Expressed Topic/ User-entered Term	Class Number/Schedule Caption	Relevant Subject Heading in Retrieved Items
Geography of Cayuga County	917.4768 Geography of and travel in Cayuga County	(none)
History of Columbia County	974.739 History of Columbia County	Columbia County, N.Y.--History
Vacation ideas in the Catskill Mountains	917.4738 Geography of and travel in the Catskill Mountains	Catskill Mountains--Description and travel
Analysis of Keynesian economics	330.156 Keynesianism	Keynesian economics
Pension reform	331.252 Pensions	Old age pensions--
Bowling	794.6 Bowling	Bowling
Soccer	796.334 Soccer (Association football)	Soccer
Bullfighting	791.82 Bullfighting	Bull-fights

8.4.4 Lists of Topics and Perspectives

Unfortunately, we cannot always count on users' topics of interest to match the terminology of Schedule captions. Thus, the searchable index of the subject outline search also contains Relative Index entry words, words from DOC Schedule notes, and, in the Dewey Online Catalog of LC, NYSL, and PLCFC, the first-listed subject heading in bibliographic records. In subject outline searches, the user-entered term is matched with words from the DDC and first-listed subject headings and can direct the user to a class number whose Schedule caption does not necessarily describe the user's topic of interest, but directs the user to relevant items. For example, a staff searcher at NYSL was performing a subject outline search for the topic "Holland purchase of the Holland Land Company." DOC directed the searcher to the class number and caption "974.79 History of Western Counties." At this point, the user started over rather than display items with this class number and caption because the latter did not specifically mention her topic. Had she displayed items, the user would have obtained the titles Joseph Ellicott and the Holland Land Company, Holland Land Company records, and Holland Land Company among the first 10 of 262 retrieved items. Another example is the subject outline search for the "New York State capitol building" in which the user-entered term "state capitol" directed the searcher to the class number and caption "917.4743 Geography and travel in Albany City." Of the 28 items retrieved, 3 items--Albany and the New York State capitol from original negatives, Capitol story, and Views of Albany, N.Y. and new capitol building--seemed relevant, and two of these three did not have any subject headings. However, the user did not display any items because he said that he did not read the introductory message to the outline telling him what to do. He did not see his topic specifically listed in the outline, and the outline was new and different to him. In fact, the outline just described New York State counties and, occasionally, cities. But the outline was prefaced by an introductory message saying "Items on your subject are found under 917.4743 in this outline of related subjects" and the topic in the outline bearing the class number 917.4743 was prefaced by an asterisk (*). The users' response to the outline in these two searches is a prime example of the saying "You can lead a horse to water but you can't make him drink it." Realizing that patron and staff participation in the online retrieval tests was their first use of the experimental online catalog, we feel that searchers needed more experience with the system to obtain successful search results.

The List of Perspectives was an intermediate result of all UI subject outline searches and of LC, NYSL, and PLCFC subject outline searches when items in more than one classification area were retrieved. The List of Perspectives was not always informative. For example, a user whose expressed topic was "Cayuga Village" entered "cayuga county" into DOC and obtained the following List of Perspectives:

```
* YOUR SUBJECT IS TREATED FROM 2 PERSPECTIVES:

LINE PERSPECTIVES
   A Geography of and travel in North America
   B Northeastern United States (New England and Middle Atlantic States)
```

The user stopped his search abruptly at this point and started over. When asked about this stoppage, the user remarked that he would have browsed the second listed perspective if it had said "History of Northeastern United States (New England and Middle Atlantic States)."

Other reported problems with the terminology of the List of Perspectives or searchers' lack of familiarity with such a list are the following:

- Faced with a long list of perspectives, I didn't know which one to choose because of my unfamiliarity with this topic ("American Corporations in South Africa"). (one staff, LC)

- I felt that the List of Perspectives was a confusing and illogical step in the searching process. I didn't know what to do with this list (in a search for "Women Executives"). (one staff, LC)

- The List of Perspectives wasn't specific to my topic (in searches for "Fort Niagara" and "New York State capitol building"). (two staff, NYSL)

- I didn't know which perspective ("Indoor sports" or "Outdoor sports") to choose because my topic (Basketball) is both an indoor and outdoor sport. (one patron, PLCFC)

Instead of using DDC Schedule captions to make up the List of Perspectives, this list could be composed of the specific Schedule captions around which the Lists of Topics are constructed. These specific Schedule captions would have to be accompanied by a more general caption than is found one level higher in the DDC hierarchy to place the specific Schedule caption in context. Moreover, the confusing or contrived wording of some specific Schedule captions would have to be changed to reflect the subject contents of items bearing the specific Schedule caption and its associated class number (see also section 8.4.7).

8.4.5 First-listed Subject Headings

Words from the first-listed subject heading in a bibliographic record were added to the searchable index of the subject outline search for two reasons: (1) to increase searchers' chances of matching their terms with indexed terms from the DDC and bibliographic records and (2) to direct users to classification area(s) where there were items whose bibliographic records contained the user-entered term. While the enhancement of the subject outline index with first-listed subject headings produced fewer subject outline searches with no retrievals than with such an enhancement, the results of subject outline searches were not always helpful with respect to the classification area(s) suggested by DDC. In most of these subject outline searches, the user was directed to a classification area that was much broader than the user-entered term for the various reasons described in this section.

```
Subject Outline Search in DOC                                             Explanation

Enter an option > ss                                                      User-entered term "Cohoes" is
Enter subject to search > cohoes                                          entered using the subject outline
                                                                          (ss) search.

>>>>> YOUR REQUEST...ss:cohoes

  Please wait ...
* YOUR SUBJECT IS TREATED FROM 2 PERSPECTIVES:

LINE  PERSPECTIVES                                                        The user retrieves records on the
   A  Geography of and travel in North America                            topic "Cohoes" from the perspec-
   B  Northeastern United States (New England and Middle Atlantic states) tives of geography and the
                                                                          Northeastern United States.

OPTION  DESCRIPTION
    BP  Browse a perspective
    SO  Start over


Enter an option > bp                                                      The user chooses the second
Enter a line to browse > b                                                perspective.

>>>>> YOUR REQUEST ...bp b

* ITEMS ON YOUR SUBJECT ARE FOUND UNDER 974.7 IN THIS OUTLINE OF RELATED
  SUBJECTS.

GENERAL  TOPIC : 974 Northeastern United States (New England and Middle   The List of Topics is constructed
  LINE ITEMS LOCATION      TOPIC                                          around the class number "974.7
*    A 4939  974.7         History of New York                            History of New York" which is
                                                                          broader than the user-entered
OPTION  DESCRIPTION                                                       topic "Cohoes." The reason why
    BG  Browse more general topics                                        the user was directed to this
    BS  Browse more specific topics                                       broad class number is because one
    GN  Get detailed notes for a topic                                    item bearing the class number
    SL  Select line(s) to display items                                   974.7 contains the user-entered
    RP  Return to perspectives list                                       term in the words of the first-
    SO  Start over                                                        listed subject heading and DOC's
                                                                          procedure of constructing the
Enter an option > bs                                                      List of Topics around the shortest
                                                                          call number retrieved.
>>>>> YOUR REQUEST...bs A                                                 The user decides to browse topics
                                                                          more specific than the one listed.
```

Fig. 42. Subject outline search in DOC for "Cohoes" (cont. on next page)

```
GENERAL  TOPIC : 974.7 History of New York
  LINE ITEMS LOCATION      TOPIC
     A 651    974.71        History of New York City Borough of Manhattan
     B 734    974.72        History of Other parts of New York metropolitan
     C 661    974.73        History of Other southeastern counties
     D 854    974.74        History of Middle eastern counties
     E 252    974.75        History of Northern counties
     F 290    974.76        History of North central counties
     G 222    974.77        History of South central counties
     H 292    974.78        History of West central counties
     I 262    974.79        History of Western counties

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    RP  Return to perspectives list
    SO  Start over

Enter an option > bs
Enter a line to browse > d

>>>>> YOUR REQUEST...bs d
```

The user again decides to browse topics more specific than those listed but must know that the county in which "Cohoes" is located is a "Middle eastern" county in New York State.

```
GENERAL TOPIC : 974.74 History of Middle eastern counties
  LINE ITEMS  LOCATION    TOPIC
     A    105  974.741     History of Rensselaer County
     B    107  974.742     History of Albany County
     C    215  974.743     History of Albany city
     D     87  974.744     History of Schenectady County
     E     50  974.745     History of Schoharie County
     F     74  974.746     History of Montgomery County
     G     36  974.747     History of Fulton County
     H     94  974.748     History of Saratoga County
     I     71  974.749     History of Washington County

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    RP  Return to perspectives list
    SO  Start over
```

The user selects the topic "History of Albany County" and displays retrieved items.

Fig. 42. Subject outline search in DOC for "Cohoes" (cont. on next page)

```
Enter an option > sl b

>>>>> YOUR REQUEST...sl b
      107 ITEMS IN SET 1  (974.742 History of Albany County)

   •
   •
   •

ITEM 24 OF 107
DEWEY NUMBER      974.742C67
COLLECTION        H
                  A
                  MA/FM
TITLE             The history of Cohoes, New York, from its earliest
                  settlement to the present time.
LC SUBJECT        Cohoes (N.Y.)--History
                  Cohoes (N.Y.)--Biography
DEWEY SUBJECT     History of Middle eastern counties. History of Albany County.
AUTHOR            Masten, Arthur Haynesworth.
PUBLISHER         1877
Would you like to see the next item? ("RETURN"=yes, N=no) >

ITEM 25 OF 107
DEWEY NUMBER      974.742C67b2
COLLECTION        H
TITLE             Brief history of the First Baptist Church, Cohoes, New York.
DEWEY SUBJECT     History of Middle eastern counties. History of Albany County.
AUTHOR            Cohoes, N. Y. First Baptist Church.
                  Coonrod, Charles H.
                  McCann, William G.
PUBLISHER         1939
```

The first mention of "Cohoes" in displayed items is the 24th item displayed. Note the absence of a subject heading in the 25th item displayed.

Fig. 42. Subject outline search in DOC for "Cohoes" (continued)

In fig. 42, a subject outline search for "Cohoes" is shown. In this search, the user was directed to the very broad class area "974.7 History of New York" where there were a total of 4,939 items bearing the exact class number 974.7 or class numbers beginning with 974.7. The user then browsed more specific topics under the class number 974.7. The specific Schedule captions were still too general for the topic "Cohoes," but the user had to know that Cohoes is a "Middle eastern" county in New York State to browse more specific topics than "974.74 History of Middle Eastern Counties." The result was yet another list of Schedule captions in which one "974.742 History of Albany County" could have contained items on Cohoes because it is a city in Albany County. In fact, the first 2 items of the 107 items retrieved under 974.742 that mentioned Cohoes were the 24th and 25th items displayed.

If items on Cohoes are retrieved under the specific class number 974.742, why did DOC refer the searcher to the class number 974.7 and not 974.742? The reason is found in the search procedures description of the subject outline search (see section 5.5.2.4, item 6). The description tells how DOC groups DDC class numbers from retrieved records such that all DDC class numbers starting with the same three digits belong to one group. If there is only one group, DOC displays the List of Topics. Otherwise, DOC displays the List of Perspectives. When the List of Topics is displayed, DOC chooses the shortest class number in the group and organizes this class number into a List of Topics with other class numbers of the same length. In the Cohoes search, there were four different subject headings containing the term "Cohoes" that were assigned as the first-listed subject heading to six items with the following three different class numbers and perspectives:

Class number	Number of Items Retrieved	Perspective
917.4742	2	917.47 Geography of and travel in New York
974.742	3	974.7 History of New York
974.7	1	974.7 History of New York

The subject outline search procedure for grouping class numbers chooses the shortest class number in the group and organizes the class numbers into a List of Topics with other class numbers of the same length and Schedule captions. When the user in the Cohoes search in fig. 42 chose the perspective "974.7 History of New York," DOC constructed a List of Topics around the shortest class number in the group with this perspective--974.7. Unfortunately, this class number area is very broad. ("History of New York" has 4,939 items.) Why would one of the items bearing this class number be about Cohoes? This item is shown below and covers three other upstate New York cities. The first-listed subject heading contains the user-entered term "Cohoes."

DEWEY NUMBER	974.7fA512
COLLECTION	H
TITLE	Cohoes, Lansingburgh, Waterford and Amsterdam. A review of their progress because of excellent location, remarkable resources and superior natural advantages.
LC SUBJECT	Cohoes, N.Y.--Description Lansingburgh, N.Y.--Description Waterford, N.Y.--Description Amsterdam, N.Y.--Description
DEWEY SUBJECT	History of New York.
SPONSOR	American journal of commerce.
PUBLISHER	1901?

In retrospect, we can say that this subject outline search would have been simplified for the user (in terms of the number of steps necessary for arriving at the most specific class number and caption for this topic) had DOC referred the user to the class number and caption with the highest number of postings, i.e., "974.742 History of Albany County," where three items bearing the subject heading word in the user-entered term "Cohoes" are found.

Table 59 lists three other patron searches in DOC at NYSL and three staff searches at LC in which the DOC searcher was directed to a very broad class number and caption instead of a specific one. The search for "Saratoga Springs" is most like the Cohoes search. In this search, the user-entered term "saratoga springs" retrieved items from the perspectives of geography and history. The DOC grouping procedure formed two groups under the class number "917.47 Geography of and travel in New York" and "974.74 History of New York," which are broader than the two specific class numbers "917.4748 Geography of and travel in Saratoga County" and "974.748 History of Saratoga County," where the majority of items that match the user-entered term are classed. Sixteen of the 36 items bearing the class number 917.4748 contain the term "Saratoga Springs" in the first-listed subject heading. Six of the 94 items bearing the class number 974.748 contain the term "Saratoga Springs" in the first-listed subject heading. The user would have been better off had DOC directed him to the specific class numbers 917.4748 and 974.748 where most of the relevant items were classed instead of the broad numbers 917.47 and 974.74.

The searcher for the "Home finance" topic was directed to the class number and caption "332 Financial economics" because one item with the class number 332 contained the user-entered term "personal finance" in the first-listed subject heading. Had DOC directed the user to the class number "332.024 Personal finance," which had the highest number of items (56) bearing the user-entered term in the first-listed subject heading, the user's task of retrieving relevant items would have been facilitated. Other examples of such subject outline searches in which the same first-listed subject heading is scattered into broad and specific class numbers and resulted in a List of Topics much broader than a List of Topics whose construction would be based on the highest posted class number are the following:

User-entered Term	Class Number/Caption	Number of Items Retrieved
football	796 Athletic and outdoor sports and games	3,818
basketball	796 Athletic and outdoor sports and games	3,818
camping	796 Athletic and outdoor sports and games	3,818
glens falls	974.7 History of New York	4,939
history of buffalo	974.79 History of Western counties	262

Table 59. Class Number Scatter of First-listed Subject Headings

Expressed Topic	User-entered Topic	Subject Heading	List of Topics	Number of Items Retrieved	Number of Relevant Items Retrieved	Class Number/Caption	Total Number of Items Retrieved with This Class Number/Caption
1. Revolutionary war in N.Y.S.	new york state revolution	New York (State)--History--Revolution, 1775-1783--	A. 974.7 History of New York	4,939	9	974.7 History of New York	4,939
					2	974.725 History of Suffolk County	152
					1	974.746 History of Montgomery County	74
2. New Lebanon, N.Y.	new lebanon	New Lebanon Congregational United Church of Christ--History	A. 974.739 History of Columbia County	102	2	974.739 History of Columbia County	102
3. Saratoga Springs	saratoga springs	Saratoga Springs, N.Y.--	A. 917.47 Geography of and travel in New York	1,815	16	917.4748 Geography of and travel in Saratoga County	36
			B. 974.74 History of Middle eastern counties	854	3	917.47 Geography of and travel in New York	1,815
					1	917.475 Geography of and travel in Northern counties	168
					1	917.4751 Geography of and travel in Warren County	15
					6	974.748 History of Saratoga County	94
					1	974.74 History of Middle eastern counties	854
4. Jewish immigration to the U.S.	Jews	Jews in New York (City)-- Jews--New York (State)-- Jews--New York (N.Y.)	A. 974.7 History of New York	4,939	4	917.47 Geography of and travel in New York	1,815
			B. 917.47 Geography of and travel in New York	1,815	8	974.71 History of New York City Borough of Manhattan	651
					2	974.743 History of Albany city	215
					1	974.738 History of Catskill Mountains	7
					1	974.771 History of Tompkins County	28
					1	974.7 History of New York	4,939
					1	974.733 History of Dutchess County	111
5. Japanese style of management	industrial management--japan	Industrial management--Japan	A. 658 General management	1,616	3	658.009 From a historical and geographical viewpoint	19
					1	658.314 Motivation, morale, discipline	48
					1	658.5 Management of production	80
6. Venture capital	venture capital	Venture capital--	A. 332 Financial economics	1,161	1	332.66 Investment banks and banking	2
					1	332.1 Banks and banking	257
			B. 658.152 Management of financial operations	47	2	658.152 Management of financial operations	47
					1	658.1522 Procurement of capital	23
7. Home finance	personal finance	Finance, personal	A. 332 Financial economics	1,161	56	332.024 Personal finance	90
					3	332.02401 Increasing income, net worth...	18
					2	332.02406 Personal finance for specific classes of people	2
					1	332.024061 Personal finance for specific classes of people	2
					1	332.678 Investment guides	33
					1	332 Financial economics	1,161
					1	332.02402 Special problems	3

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Five searches in table 59--"Revolutionary war in N.Y.S.," "New Lebanon, N.Y.," "Jewish immigration to the U.S.," "Japanese style of management," and "Venture capital"--also referred the user to a broad classification area. However, no one classification area featured a majority of items containing the user-entered term.

The classification area that does feature the majority of items containing the user-entered term had many postings on the topics. The searches for the "Revolutionary War in N.Y.S." and "Jewish immigration" were the best examples. In the former, the user-entered term "new york state revolution" directed the searcher to the class number "974.7 History of New York." Of the 11 items bearing the user-entered term "new york state revolution," 8 (or the majority of them) were also assigned the class number 974.7. Unfortunately, nearly 5,000 other items also contained the exact class number 974.7 or class numbers starting with 974.7. In this subject outline search, it probably was not wise for the user to display and scan items bearing the exact class number 974.7 because it was going to take him a long time to find these eight items. A direct search for "new york state revolution" would probably be the user's best course of action at this point.

In the search for "Jewish immigration," the user-entered term "jews" directed the searcher to the class number "917.47 Geography of or travel in New York," with 1,815 items, and to the class number "974.7 History of New York," with 4,939 items. The first-listed subject heading matched eight of the 615 items with the class number "974.71 History of New York City Borough of Manhattan." At this point, the user's best course of action was to start over and perform a direct search in DOC or alphabetical search in SOC for the user-entered term.

The performance of all seven of the subject outline searches in table 59 could have been improved by altering the subject outline search procedure to (1) construct the List of Topics around the highest posted class number(s) and (2) alter the display of retrieved items so that the first items displayed are those items that would be retrieved in a direct search for the topic and bear the highest posted class number around which a List of Topics has been constructed. For example, the subject outline search for "new york state revolution" would direct users to the highest posted class number (974.7), display the eight items that contained the user-entered term (new york state revolution) with this class number (974.7) first, and then display the remaining records with this class number prefaced by a message, such as "Other items in this shelf area are:". If the user displays a number of records after this message, he might get the idea that not all of the records bearing this class number (and on the bookshelf in this area) are about his topic of interest.

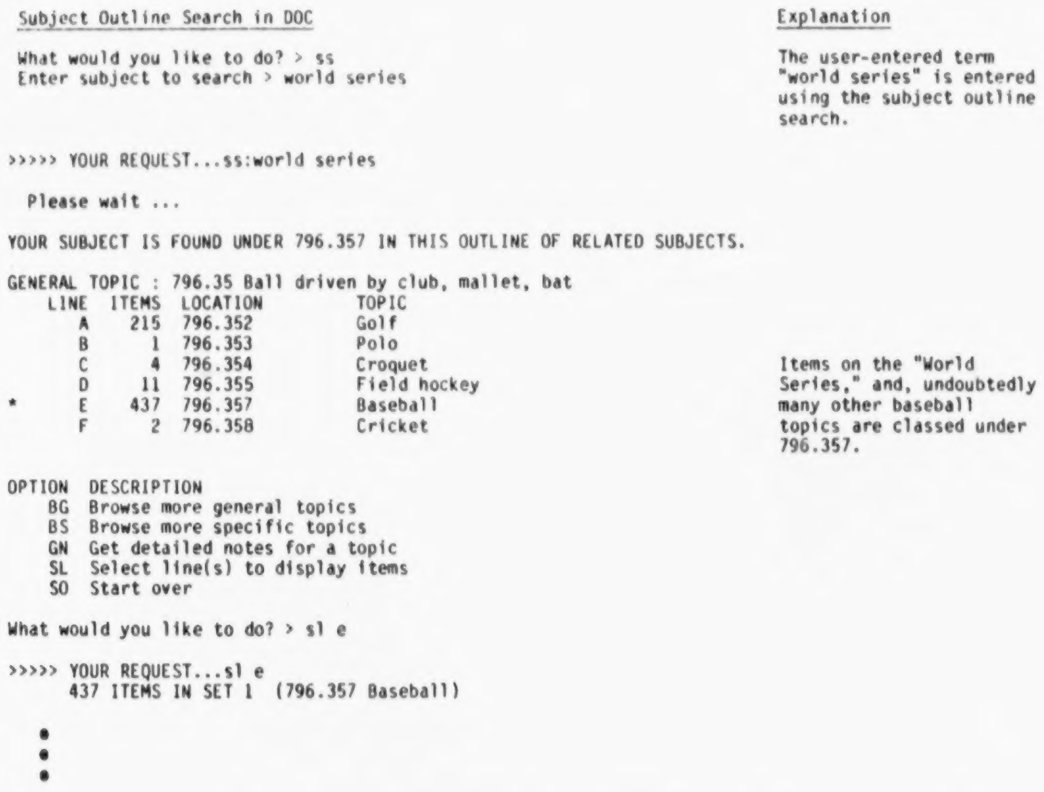
Patron and staff searchers were quite vocal about their disappointment in subject outline searches. Their comments about unsuccessful subject outline searches are the following:

- The system should direct you to specific areas of the DDC Schedules, not very broad topics (in searches for "Starting a small business" and "Venture capital"). (two staff, LC)

- This shows you how broad the DDC is. It seems you are trying to narrow your search (for "Food problems in third world countries, especially in Africa") and DDC sends you to "Agriculture." It should send you to "Food supply." (one staff, LC)

- When I was presented with a list of New York State counties by general area, e.g., Middle eastern, Western counties, and I didn't know which area my county of interest would be found to continue searching for specific topics (in a search for "Cohoes"). (one patron, NYSL)

- I was surprised that my topic (Jewish immigration to the U.S.") was treated from the perspective of geography. (one patron, NYSL)



```
 Subject Outline Search in DOC                                   Explanation

 What would you like to do? > ss                                 The user-entered term
 Enter subject to search > world series                          "world series" is entered
                                                                 using the subject outline
                                                                 search.

>>>>> YOUR REQUEST...ss:world series

  Please wait ...

YOUR SUBJECT IS FOUND UNDER 796.357 IN THIS OUTLINE OF RELATED SUBJECTS.

GENERAL TOPIC : 796.35 Ball driven by club, mallet, bat
    LINE  ITEMS  LOCATION         TOPIC
       A    215  796.352          Golf
       B      1  796.353          Polo
       C      4  796.354          Croquet                        Items on the "World
       D     11  796.355          Field hockey                   Series," and, undoubtedly
*      E    437  796.357          Baseball                       many other baseball
       F      2  796.358          Cricket                        topics are classed under
                                                                 796.357.

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > sl e

>>>>> YOUR REQUEST...sl e
     437 ITEMS IN SET 1  (796.357 Baseball)

   •
   •
   •
```

Fig. 43. Subject outline search in DOC for "World Series" (cont. on next page)

```
ITEM 100 OF 437    The 100th and 101st items
CALL NUMBER       796.357/D95h2      displayed were the first
TITLE             Highlights of the world series.  ones specifically
LC SUBJECT        World series (Baseball)     mentioning "World Series"
DEWEY SUBJECT     Ball driven by club, mallet, bat. Baseball.
AUTHOR            Durant, John, 1902.
EDITION           [2d ed., rev. and enl.]
PUBLISHER         New York, Hastings House [1971]

Would you like to see the next item? ("RETURN"=yes, N=no) >

ITEM 101 OF 437
CALL NUMBER       796.357/D95h3
TITLE             Highlights of the world series.
LC SUBJECT        World series (Baseball)
DEWEY SUBJECT     Ball driven by club, mallet, bat. Baseball.
AUTHOR            Durant, John, 1902-
EDITION           [3d ed., rev. and enl.]
PUBLISHER         New York, Hastings House [1973]

Would you like to see the next item?  ("RETURN"=yes, N=no) >n
o
o
o
What would you like to do? > bs e

>>>>> YOUR REQUEST...bs e

GENERAL TOPIC : 796.357 Baseball
    LINE  ITEMS  LOCATION        TOPIC
       A     97  796.3570        General aspects. Examples: Journals, Study
       B     10  796.3572        Strategy and tactics
       C      2  796.3573        Umpiring
       D      0  796.3576        Specific types of baseball    Browsing more
specific
       E      0  796.3577        Various specific games   topics than "796.357
       F     22  796.3578        Variants  Baseball" shows that no
    items have been assigned
OPTION  DESCRIPTION     class number "796.3577
    BG  Browse more general topics     Various specific games"
    BS  Browse more specific topics    or more specific numbers
    GN  Get detailed notes for a topic which include "796.357782
    SL  Select line(s) to display items     World Series."
    SO  Start over

What would you like to do? >
```

Fig. 43. Subject outline search in DOC for "World Series" (continued)

At the PLCFC, a number of subject outline searches for specific topics directed searchers to a broad classification number even though there was a more specific number describing the user-entered topic. The reason for this is not DOC's subject outline search but the library's practice of assigning broad class numbers to items on a topic, even though the DDC Schedules feature a specific number for the topic. Fig. 43 shows a subject outline search for the "World Series." If the library assigned the specific class numbers in the DDC Schedule to items on this topic, items on the World Series would bear the class number 796.357782. However, the library classifier assigned the general class number "796.357 Baseball" to nearly all of the library's books on baseball. Thus, a subject outline search for "world series" directs the user to the class number "796.357 Baseball" with 437 postings. The 100th and 101st items displayed in the set of 437 items on baseball were the first items that mentioned the "World Series." Both bore the class number 796.357. The specific class number "796.357782 World Series" has not been assigned since no items were posted to the class number "796.3577 Various specific games" in DOC's cumulative postings list in fig. 43.

Other searches affected by this library practice are summarized in table 60. The patron who performed the search for "Karate" was particularly upset because items on karate were classed along with over 100 others in a general number "796.815 Jujitsus (Yawara)." Thus, the user displayed items on topics other than karate, e.g., kempo, nunchaku, kung fu, and aikido, among the set of items retrieved in a subject outline search for "karate." Furthermore, many of these other topics also had a specific class number for assignment which the library did not use.

This library practice frustrates users who have to display title after title to find relevant items and confuses users who find a more specific class number for their topic which contains no items even though the library has books on the topic. Relative Index entries were not processed into DOC when there were no items under the class number of the Relative Index entry. So, entries such as "Swimming--sports," "World--series games--baseball sports," and "Karate--sports" were not processed into DOC and alphabetical searches under these terms were bound to fail.

This library practice places the burden of finding items on a specific topic on searchers. They have to scan through long displays of retrieved items and, should they browse more specific topics, they have to figure out for themselves that items on specific topics are not classed in a class number devoted to the specific topic but in the broader number and topic to which they were first referred in the subject outline search. If the searchable index of the subject outline search in DOC at the PLCFC had been built like the index of the subject outline search in UI, i.e., without words in the first-listed subject heading, subject outline searches for "World Series," "Karate," and the other topics in table 60 would have directed searchers to class numbers and captions with no retrievals. For example, the subject outline search on "World Series" in fig. 43 would have directed the searcher to "796.357782 World Series" because the DDC Schedule caption matches the user-entered term. In this instance, the user would have had to browse more general topics until he arrived at a suitable caption to describe this topic.

Libraries considering implementing a subject outline search in their online catalog must consider the effect of their local classification practice on the subject outline search. In the Dewey Online Catalog at PLCFC, subject outline searches included the first subject heading in the library's bibliographic records and the results of such searches reflected such practice. In DOC at UI, subject outline searches only considered subject information in the DDC and did not include the first-listed subject heading in this search's index. Because UI classification practice reflected the DDC, this was a satisfactory representation of the subject matter of the library's records.

Table 60. Subject Outline Searches Affected by Classing Items in General Class Numbers

Expressed Topic	User-entered Term	Actual Class Number/Caption	Number of Items	Used Class Number/Caption (List of Topics)	Number of Items Retrieved	Examples of Other Topics Retrieved
Karate	karate	796.8153 Karate	0	796.815 Jujitsus (Yawara)	177	kempo martial arts kung fu aikado
Touch football	touch football	796.3328 Variants	1	796.332 American football	438	Buffalo Bills Football coaching Football offense Ohio State football
Teaching infants to swim	swimming	797.21 Swimming	0	797.2 Swimming and diving	136	Surf riding Diving
Improving your golf swing	golf swing	796.3523 Tactics of play	0	796.352 Golf	215	Putting Golf rules Wedges Chipping
Deer hunting	deer hunting	799.232 With falcons	5	799.2 Hunting	144	Fox-hunting Tiger hunting Falconry Shooting

Online retrieval test participants at PLCFC noticed that items on specific topics were not classed into specific DDC numbers and remarked

- Items on my subject ("Soccer") were all bunched together into one topic and there were few items in more specific topics. (one patron, PLCFC)
- There were no items under a topic matching my subject ("Karate"), so I had to browse more general topics, and, surprisingly, found relevant items under the general topic. Why weren't these items found under the specific topic? (one patron, PLCFC)
- I found a highly posted topic ("796.352 Golf" and "797.2 Hunting") but there were zero items in a relevant topic obtained from browsing more specific topics. The catalog should have classed books on the specific topic ("Improving your golf swing" and "Deer hunting") into their proper place in the specific topics in the classification. (two staff, PLCFC)

- Sometimes the BS (browse more specific topics) doesn't help you because (1) there are no more specific topics, or (2) no items are posted in the specific topic. (one staff [in a search for "Teaching infants to swim"], PLCFC)

8.4.6 Enhancement of Bibliographic Records

The enhancement of bibliographic records combined with the subject-rich information in these records was sometimes responsible for directing DOC users to broad classification area(s) and/or nonrelevant classification area(s). In a subject outline search for "Integration," the user was directed to class number "515 Analysis" because the Schedule captions, notes, and/or Relative Index entries for more than one specific class number beginning with 515 contained the word "Integration." The specific class numbers under 515 and the source of "Integration" are listed below:

Class Number	Actual Number of Items Retrieved	Reason for Retrieval
515.42	16	DDC Relative Index entry "Integration--theory--calculus" or Schedule caption "Theory of measure and integration"
515.43	23	DDC Relative Index entry "Integration--calculus--" or word "Integration" in general note in Schedules
515.624	5	DDC Relative Index entry "Numerical--integration" or Schedule heading "Numerical integration"

DOC's procedure for grouping retrieved DDC class numbers and choosing the shortest number in the group was responsible for directing the user to the shortest class number in this group which was 515. If DOC's grouping procedure were based on the greatest number of items retrieved bearing the user-entered term per class number, the user would have been directed to 515.43 where 23 items are classed. Had the user been directed to a List of Topics constructed around 515.43, he might have seen the number and caption "515.42 Theory of measure and integration" which might have been more appropriate for his topic. Finding the class number "515.624 Numerical integration" would have taken considerable browsing or another subject search option. However, a direct search on "Integration" would have retrieved items under all three class numbers in 515.

Table 61 lists three other searches which direct searchers to broad classification area(s) or nonrelevant area(s). The subject outline search for "Vector analysis" is similar to the "Integration" search. It directs the searcher to 515 because the two specific class numbers retrieved are in the 515's. If the suggested improvement to subject outline searches were implemented in DOC (i.e., direct the searcher to the class number with the most postings for the user-entered term), the result of a subject outline search for the user-entered term "vector analysis" would not be satisfactory. DOC would direct the user to the higher posted area ("515.73 Functional analysis") because a total of 31 items contained the user-entered term. The lower posted area ("515.63 Vector, tensor, spinor analysis") is the relevant area of the two, but DOC would not have referred the user to 515.63 because only 17 items bear the user-entered term. If the suggested improvement to subject outline searches were implemented in DOC, the search for "Livingston County" in table 61 would have directed the user to the relevant number "974.785 History of Livingston County" because the other class "974.739 History of Columbia County" retrieved only 3 items with this class number which contained the user-entered term in a subject heading word (Livingston, N.Y.) and word in the Schedule caption ("History of Columbia County").

Table 61. Subject Outline Searches Directing Users to General Class Numbers

Expressed Topic	User-entered Topic	List of Topics	Actual Class Number	Actual Number of Items Retrieved	Reason for Retrieval
Vector analysis	vector analysis	515 Analysis	515.63	17	Relative Index entry "Vector analysis" or Schedule caption "Vector, tensor, spinor analysis."
			515.73	31	Relative Index entry "Topological--vector--spaces" and Schedule caption "Functional analysis."
Livingston County	livingston county	974.7 History of New York	974.739	3	Subject heading "Register of births, etc.--Livingston, N.Y." and Schedule caption "History of Columbia County."
			974.785	25	Schedule caption "History of Livingston County" or subject headings "Livingston County, N.Y.--"
Implicit Differentiation	differentiation	515 Analysis	515.33	8	Relative Index entry "Ordinary--differentiation--calculus."
			515.623	0	Schedule caption "Numerical differentiation."

There is no easy solution to the problem of subject outline searches that result in two or more class number areas within one broad class area. If the system were to direct users to the highest posted specific class area, the result could be a relevant area as we have already demonstrated in the search for "Livingston County" or a nonrelevant area as we have shown in the search for "Vector analysis." In such subject outline searches as the latter, users who are familiar with the subject area might browse specific topics until they find a satisfactory classification number area describing their topic of interest while users unfamiliar with the subject area will probably start over and select a different subject searching option.

For a number of reasons, subject outline searches directed patrons and staff to general classification areas and they remarked about this result:

- Listed topics were too broad in concept to cover my topic ("Mime"). A finer subject breakdown is needed. (one patron, PLCFC)
- The List of Topics was made up of topics and three-digit numbers, e.g., 510, 511, 512, which were not specific to my topic ("Implicit differentiation"). I didn't know which topic to choose because they were so broad. (one patron, UI)
- The system needs definitions for listed topics to tell what they are about, especially for general numbers such as 510, 511, and so on. (one staff, UI)
- The subject outline search works well when it directs you to specific captions with few postings (as in my search for "Terrorism"). (one staff, NYSL)
- The List of Topics were broad in concept with too many items (in searches for the "Solar energy industry" and "Marketing at the turn of the century"). (two patrons, LC)

8.4.7 Limiting the Results of Subject Outline Searches

In subject outline searches directing users to both specific and general class areas, users felt that the outline was sufficient for finding items on one facet of their multifaceted topic but wanted to limit the results by other criteria, such as another term or year of publication. For example, the patron's search on "Jewish immigration to the U.S." resulted in 1,815 items with the class number "917.47 Geography of and travel in New York" and in 4,939 items with the class number "974.7 History of New York." Had the user limited the results of the former class number with the subject heading word "jews," he would have retrieved items with titles such as Old east side, Jewish landmarks in New York, Orchard Street, and The face of faith, an American Hassidic community. Limiting the latter class number, the user would have retrieved titles such as How we lived: a documentary history of immigrant Jews in America, 1880-1930 and Portal to America: the lower east side, 1890-1925. The patron who performed a subject outline search for the topic "Revolutionary War in New York State" was directed to the general class number "974.7 History of New York." Evaluating this result, the user wanted to see items specific to the Revolutionary War in this state. Even if DOC had had a limit capability, the user insisted that this war was called the "revolutionary war" and would only enter this term into the catalog. (When zero items were retrieved in subject outline and direct searches for "new york in the revolutionary war," the user finally gave in to entering the subject heading word "revolution" in a subject outline search which referred her to class number 974.7.) Thus, a limit capability is recommended in online catalogs with subject outline searches that enables the searcher to enter and match his term with all subject-rich fields of bibliographic records. Subject outline searches whose performance could have been improved with the availability of a limit by keyword capability are the following:

Expressed Topic	User-entered Term	Class Number/Caption	Keyword(s) for Limiting Results
Poughkeepsie	poughkeepsie	974.733 History of Dutchess County	poughkeepsie
Computers as an aid to mathematical statistics	statistics	519.5 Mathematic statistics	computers data processing
Detective movies	detective	791.4 Motion pictures, radio, television	detective
Athens, N.Y.	athens	974.737 History of Greene County	athens
Civil War	civil war	974.7 History of New York	civil war

Originally, such a limiting capability was designed for and implemented in the experimental online catalog (see fig. 4). However, we were faced with a severe space limitation in the LSI-11 computer used to develop these catalogs. To alleviate the limitation, we decided to eliminate Boolean searching capabilities associated with refining the ongoing subject search. We did not think that this refinement technique would be crucial to the experimental online catalog because both SOC and DOC still featured a keyword searching capability with implicit Boolean operations, i.e., direct (SD) searching. But the user had to reenter his topic expressed in a single search statement rather than use the results of previously entered search statements and Boolean operations. In retrospect, we feel that the omission of this refinement technique provided us with valuable knowledge of users' needs in an online catalog in which the DDC has been incorporated as a searcher's tool for subject access, browsing, and display.

Users' experiences in DOC subject outline searches and their remarks in post-search interviews are indicative of the need for a limit by keyword capability in subject outline searches.

- I wanted to limit the topic retrieved in an SS search ("974.723 History of Borough of Brooklyn" and "973.26 Extension of English rule, 1732-1763") by another term (new netherlands; battles) (in searches for "New Netherlands" and "French and Indian War"). (two patrons, NYSL)

- I wanted to enter another term into DOC in a subject outline search (for "Revolutionary War in N.Y.S."; "Indians"; "Geography of Columbia County") when the system led to a topic with over 4,900 items. (three patrons, NYSL)

- I wanted the ability to limit search results by a city name in an outline which only listed counties. (In searches for "Turn of the century views of Saratoga Springs" and "Poughkeepsie"). (one staff, NYSL; one patron, NYSL)
- In DOC, it would be useful to limit output when there are many items retrieved (in searches for "Computers as an aid to mathematical statistics," "Linear algebra," "Functional analysis," and "Rings"). (four staff, UI)
- There is no way to qualify retrieved items when a lot are retrieved (in searches for "Statistics," and "Group theory"). (two patrons, UI)
- There was no way to enter another term to limit the results in an SS search (for "Gymnastics"; "Basketball"; "Game hunting without guns"; "Cross country skiing"; and "Soap operas"). (two patrons, PLCFC; three staff, PLCFC)
- I wanted to narrow my topic by a specific term, i.e., hiking, after finding the relevant part of the outline for the Adirondacks. (one staff, NYSL)

Subject outline searches in LC and PLCFC directing users to highly posted class areas are a special case that deserves discussion. The user-entered term matched subject heading words and referred the user to a classification number whose DDC caption did not describe the user-entered term or facet of the user-entered term. For example, a user's search for "carole lombard" directed the user to the class number and caption "791.4302 Standard subdivisions" where there were two items on Carole Lombard and 238 other items with titles such as The films of Hedy Lamarr, Screen queens: heroines of the horrors, and The Swashbucklers. Fig. 44 features the outline displayed to the user in response to the user-entered term "carole lombard." When the user displayed this outline, he was amazed that there were 240 items. He displayed a few items, and, when they weren't on "Carole Lombard, he was disappointed. Other searches which resulted in outlines whose topics were ambiguous or confusing to searchers were the following:

User-entered Term	Class Number/Caption	Number of Items Retrieved
China economic conditions	330.9 Geographical treatment (Economic geography)	115
globe theatre	792.094 Geographical and personal treatment	114
steel industry	380.145 Products of secondary industries	337
	331.766 Extractive, manufacturing, construction	4
	382.45 Products of secondary industries	72
silent films	791.4309 Standard subdivisions	575
women executives	331.481 Other than extractive, manufacturing, construction	16
corporations south africa	332.67309 Historical and geographical treatment	17

Subject Outline Search in DOC

```
Enter subject to search > carole lombard

>>>>> YOUR REQUEST...ss:carole lombard

  Please wait ...

YOUR SUBJECT IS FOUND UNDER 791.4302 IN THIS OUTLINE OF RELATED SUBJECTS.

GENERAL TOPIC : 791.430 General aspects. Examples : Journals,Study
    LINE  ITEMS  LOCATION        TOPIC
       A     36  791.4301        Standard subdivisions
*      B    240  791.4302        Standard subdivisions
       C     23  791.4303        Standard subdivisions
       D      0  791.4304        Standard subdivisions
       E      7  791.4305        Standard subdivisions
       F      9  791.4306        Standard subdivisions
       G     22  791.4307        Standard subdivisions
       H     12  791.4308        Standard subdivisions
       I    575  791.4309        Standard subdivisions

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? >
```

Explanation

The user-entered term is "carole lombard."

In response to the user-entered term, DOC constructs an outline of topics made up of the topic "Standard subdivisions" which does not describe the user-entered term.

Fig. 44. Subject outline search in DOC for "Carole Lombard"

Library patrons and staff whose subject outline searches referred them to highly posted topics with confusing wording were usually looking for information on a personal name, geographical area, a specifically named place, or a specifically named industry, product, or service. Users did not understand outlines composed of such topics or know how to continue the search and told us about these experiences:

- Listed topics were all the same and they were too general to focus on my topic ("Mexico's economic problems," "American corporations in South Africa"). I would like to narrow the topic in a category. (two staff, LC)
- Seven of ten outline topics read "Treatment by specific continents" and there was no way to penetrate this outline by entering a geographic area (in a search for "Trade with the new Vietnam"). (one patron, LC)
- The outline topics called "Extractive, manufacturing, and constructive" were repetitive and not very helpful (in a search for "Employment for accounting"). (one patron, LC)

- What does "Standard subdivisions" mean? (in searches for "Carole Lombard;" "Cartoons;" and "Silent films"). (one patron, PLCFC; two staff, PLCFC)

- It is hard to narrow down a topic (in searches for "Japanese style of management," and "Employees' representation in management"). (two staff, LC)

Once searchers displayed retrieved items in these subject outline searches, they noticed that the items were not specifically on their topics of interest and expressed a need for limiting items retrieved by another term. If subject outline searches were improved as described in section 8.4.5, the first items displayed in subject outline searches would be items whose Schedule caption and notes, Relative Index entries, and first-listed subject headings contained the user-entered term. The display of these direct matches would be followed by the display of the remaining items prefaced by an explanatory message, such as "Other items in this shelf area are:". If few of these remaining items were relevant to the user's topic, the user would stop his display and continue or terminate the search.

There were other captions in the DDC Schedules that users had difficulty understanding. For example, a patron searching for "football" was unsure what the caption "Inflated ball driven by foot" meant. Another patron said, "I had to read each line in the outline carefully and think about what types of books would be covered by such a topic." Online retrieval test participants clamored for specific wording of topics and greater depth in outlines.

- Provide greater depth in the subjects listed in the outline (in searches for "Wind as a source of energy" and "Starting a small business"). (two staff, LC)

- I couldn't narrow my search for "Cold weather camping" by following the outlines. The outline under "Camping" needs finer categories. (one staff, PLCFC)

- Outline topics only refer to counties. Add city names or a breakdown by chronological periods or a breakdown by east, west, north, and south parts of counties. (four patrons, NYSL; two staff, NYSL)

- The outline led me to relevant items but greater specificity in the outlines would be appreciated (in searches for "Karate" and "Skiing and skin diving"). (two patrons, PLCFC)

8.4.8 Discussion of Subject Outline Searches

This failure analysis of the subject outline search has been especially critical of this search option. In an online catalog, the subject outline search provides a new approach to subject searching and its performance requires careful scrutiny to ensure that future system designers do not repeat our design and implementation but follow our recommendations for improving this capability so that it yields better results in online catalog searches.

In future design of this subject searching capability, we should not overlook the benefits that searchers derived from this capability:

1. Stimulating users with regard to searching terminology
   - The subject outline search saved me from entering additional terms. It did most of my work for me (one staff, UI). The outline gave me more ideas on my topic and related topics (two patrons, LC). The outline helps you organize your thinking on a topic (one patron, LC). Browsing more specific terms gives you ideas for more terms (one staff, LC).

2. Placing a topic in context
   - The outlines put topics in context with other related topics (one staff, UI). This option gives you a hierarchical approach to a topic which is slow for one to use but good if you don't know exactly what you're looking for (one patron, NYSL). This option provides you with a list of related terms (one staff, LC).

3. Showing where items are located on the shelf
   - The outline informed me of the call number area where I can find books on my subject (one staff, UI; one patron, LC). I like classification numbers included in the List of Topics (one patron, NYSL). The outline gives you locations of books on the shelf and the topics covered by those locations (one patron, UI). You don't have to go "all the way" (to the display of bibliographic records) to find books (one patron, UI). The outline told me the exact call number to consult for my topic (one staff, LC).

4. Providing a logical organization of topics
   - I like the organization of topics by county (one patron, NYSL). The BS (browse specific topics) option allows you to zero into a geographical area and is better than the alphabetical approach (one patron, NYSL). The BS option led me down a hierarchy from a very broad topic to a specific topic where I found relevant items that I didn't find in the alphabetical approach (one patron, LC). I found my subject ("Stage make-up") easier by following the outline than consulting LCSH (one staff, PLCFC).

5. Providing a capability to browse specific topics
   - The BS (browse specific topics) and BG (browse general topics) options allow you to narrow and widen your topic (one patron, NYSL; three patrons, UI; one staff, PLCFC; one patron, PLCFC; one patron, LC).

6. Showing users the disciplines which treat their topics of interest
   - The List of Perspectives lets you zero into the subject area where you want your subject to fall (one staff, PLCFC). I understand how my topic is grouped by reviewing this list (one staff, LC).

7. Referring searchers to shelf location(s) based on user-entered terms
   - I thought you'd have to enter a call number to find items, but I entered words and found items, which was very nice (one staff, PLCFC). DOC constructs relationships from words you enter into the catalog (one patron, LC).

Subject outline searches were supported by the BP (browse perspectives), SL (select lines to display items), BS and BG (browse specific or general topics) options; in most subject outline searches, users had to employ these supporting options to effect a successful search.

Few users called upon the BG option and most were referred to relevant items through the SS option directly, or the BP, SL, and BS options. Successful subject outline searches were those in which the user-entered term matched the terminology of a Schedule caption, Relative Index entry, and/or subject heading and directed the user to a specific class number where relevant items on a topic were retrieved and displayed. This scenario was not always a successful one for the following reasons:

1. The listed topic did not necessarily describe the user's topic of interest so the user didn't display any or a sufficient number of items to find ones on his topic of interest.

2. The listed perspective did not necessarily describe the user-entered topic or the user's point of view with regard to his topic of interest so the user started over.

3. When a subject heading matching the user-entered term was assigned to items by the subject cataloger, it was assigned to an item with a short (three- or four-digit) class number and a number of items with specific numbers. DOC's grouping procedure in the subject outline search directed the user to the shortest class number which usually was highly posted and broader than the user's topic of interest.

4. The user-entered term matched words in a relevant subject heading, but this subject heading was not used very often in the database and, when it was used, items with this heading were classed in a number with many other items on different topics. Thus, the user-entered term directed the user to a class number that was highly posted and broader than the user's topic of interest.

5. The library classifier assigned items on a specific topic to a broad topic and class number that could have been classed into a specific number and topic. Thus, the user retrieved items specifically on his topic and many other topics.

6. The user-entered term matched words in a relevant subject heading and/or words from a relevant DDC class number area, and, at the same time, matched words in another relevant subject heading and/or words from a relevant DDC class number area with the same base class number as the other matched class number. DOC's procedure for grouping retrieved DDC class numbers and choosing the shortest number in the group was responsible for directing the user to a short number which was broader than the user's topic of interest and highly posted.

7. The user-entered term matched words in a relevant subject heading and/or words from a relevant DDC class number area, and, at the same time, matched words in nonrelevant subject heading and/or words in a nonrelevant DDC Schedule caption, note, or Relative Index entry with the same base class number as the other matched class number. DOC's procedure for grouping retrieved DDC class numbers and choosing the shortest number in a group was responsible for directing the user to a short number which is broad and highly posted.

8. The user-entered term matched words in a relevant subject heading and directed the user to an outline that expressed one facet of the user's multifaceted topic of interest.

9. The user-entered term matched words in a relevant subject heading and directed the user to an outline whose topics were worded in an ambiguous or confusing way which prompted the user to start the search over again or fail to display items. Most displayed items were nonrelevant to the user's topic of interest.

10. The user-entered term matched words in a relevant subject heading and directed the user to an outline whose topics were more general than the user's topic of interest. Browsing more specific topics did not yield topics specific to the user-entered topic because the user had reached the lowest level of the DDC.

Suggested improvements to the subject outline search to provide better searching performance in such searches are the following:

- Changing the grouping procedure so that DOC directs users to the class number and caption with the highest number of postings during the grouping procedure. (Improves searches with problems 3 and 6; improves some searches with problem 7 and adversely affects some searches with problem 7)

- Providing a limit by keyword, date, language, or other criteria as an option when the results of a subject outline search are displayed. (Improves searches with problems 3, 5, 6, 8, 9, and 10)

- Enhancing the display of retrieved items so that the first items displayed in subject outline searches are those that would be retrieved in a direct search for the user-entered term and bear the class number of the outline. (Somewhat improves searches with problems 1, 4, 8, and 9)

Unfortunately, changing the grouping procedure so that DOC directs the user to the class number and caption with the highest number of postings adversely affects problem 7 because the highest posted class number might not be the relevant one. Problem 3, however, occurred so frequently in the experimental online catalog that we have to recommend this improvement. Searchers directed to a nonrelevant class area(s) can browse more general and specific topics to find a relevant area because they are already in a relevant 3-digit class number area for their topic of interest.

Suggested improvements to the DDC to provide better searching performance in online catalog searches are the following:

- Enriching the wording of DDC Schedule, especially captions accompanying three-digit DDC numbers, so that their wording describes the subject matter of items assigned the particular class number. Providing more subject-rich notes for Schedule captions. (Improves searches with problems 1, 2, and 9)

- Increasing the specificity of the DDC by adding more specific captions and levels of the hierarchy under highly posted DDC class numbers and captions; (such highly posted topics would have to be identified in an online union catalog of bibliographic records). (Improves searches with problem 10)

Library classification practice should be studied when implementing a subject outline search. If the library has not classified their collection using specific DDC numbers, then a subject outline search for that library's records that does not include subject headings in the searchable index of this search will direct users to class numbers that are unused by the library. Including subject headings in the subject outline search ensures that the performance of this search reflects the library's practice of the classification.

8.5 Alphabetical Searches

8.5.1 Introduction

Alphabetical searches in SOC produced an alphabetical list of subject headings in response to the user-entered term. Selection of a heading(s) from this list resulted in a set of items bearing the user-selected subject heading(s). The alphabetical search in DOC produced an alphabetical list of Relative Index entries. Selection of a Relative Index entry(ies) from this list resulted in a set of items bearing the user-selected Relative Index entry(ies) (which was not displayed to the user) and class numbers common to both retrieved items and Relative Index entry(ies).

The ability of the alphabetical search to direct users to relevant items was not wholly dependent on the system's producing an alphabetical list of subject headings or Relative Index entries whose third listed heading or entry was the closest match of the user-entered term with the system's indexed subject headings and Relative Index entries. SOC users could manipulate this list in various ways to find the best match of the user-entered term or most appropriate heading in the alphabetical list that described the user's topic of interest by:

- Browsing forward in the alphabetical list of subject headings (BF option)

- Browsing backward in the alphabetical list of subject headings (BB option)

- Selecting one or more listed subject headings to display items (SL option)

DOC users could also manipulate this list in various ways to find the best match of the user-entered term, the most appropriate entry in the alphabetical list that described the user's topic of interest, or the most appropriate caption in logical lists of the DDC Schedules by

- Browsing forward in the alphabetical list of Relative Index entries (BF option)
- Browsing backward in the alphabetical list of Relative Index entries (BB option)
- Selecting a listed entry to display the logical list of the DDC Schedule captions (ST option)
- Selecting one or more listed entries or Schedule captions to display items (SL option)
- Browsing captions more specific than those listed in a logical list (BS option)
- Browsing captions more general than those listed in a logical list (BG option)

8.5.2 Retrieving Relevant Items in Alphabetical Searches

Tables 62 and 63 show in numbers and percentages how often SOC and DOC searchers were successful retrieving and displaying relevant items in alphabetical searches. Since this subject search option was dependent upon other SOC and DOC options for directing users to relevant items, those options are also listed in these two tables.

What should be immediately apparent is searchers' inability to match their entered terms letter-for-letter with an indexed subject heading or Relative Index entry. Five percent of patron-entered terms and 7% of staff-entered terms were letter-for-letter matches of indexed subject headings in SOC. The percentages of UI patrons (10%) and UI staff (14%) whose entered terms matched an indexed subject heading were the highest percentages obtained at the four participating libraries.

Table 62. Alphabetical Searches Directing Patrons to Relevant Items

	LC SOC	LC DOC	NYSL SOC	NYSL DOC	PLCFC SOC	PLCFC DOC	UI SOC	UI DOC	Total (Four Libraries) SOC	Total (Four Libraries) DOC
1. Patrons' selection of the alphabetical (SA) search option	65	31	50	41	78	39	67	41	260	152
a. Relevant items	1	0	0	0	5	0	7	0	13	0
b. Percentages of times SA option led directly to relevant items	2%	0%	0%	0%	6%	0%	10%	0%	5%	0%
c. Percentage of times zero items retrieved	88%	97%	94%	100%	60%	100%	52%	98%	72%	99%
d. Percentage of times zero items retrieved when close matches are in the alphabetical list and are counted as matches	60%	84%	59%	83%	38%	34%	34%	44%	47%	60%
2. Patrons' selection of the browse forward (BF) option	11	1	6	0	14	1	17	4	48	6
a. Relevant items	7	1	3	0	8	1	5	1	23	3
b. Percentage of times BF option led directly to relevant items	64%	100%	50%	0%	57%	100%	29%	25%	48%	50%
3. Patrons' selection of the browse backward (BB) option	4	0	0	1	3	0	5	0	12	1
a. Relevant items	1	0	0	0	3	0	5	0	9	0
b. Percentage of times BB option led directly to relevant items	25%	0%	0%	0%	100%	0%	100%	0%	75%	0%
4. Patrons' selection of the select a topic (ST) from listed topics option	NA	3	NA	1	NA	4	NA	9	NA	17
a. Relevant items	NA	0	NA	1	NA	0	NA	1	NA	2
b. Percentage of times ST option led directly to relevant items	NA	0%	NA	100%	NA	0%	NA	11%	NA	12%

Table 62. Alphabetical Searches Directing Patrons to Relevant Items (continued)

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
5. Patrons' selection of the select line (SL) to display items option										
a. Selection of SL option in connection with the SA option	46	9	19	12	53	13	54	18	172	52
b. Selection of SL option in connection with the ST option	NA	0	NA	6	NA	0	NA	4	NA	10
c. Relevant items when selected with the SA option	25	5	12	8	38	8	20	12	95	33
d. Relevant items when selected with the ST option	NA	0	NA	2	NA	0	NA	2	NA	4
e. Percentage of times SL option led to relevant items	54%	56%	63%	56%	72%	62%	37%	64%	55%	60%
6. Patrons' selection of the browse specific (BS) topics option	NA	1	NA	0	NA	1	NA	4	NA	6
a. Relevant items	NA	1	NA	0	NA	1	NA	4	NA	6
b. Percentage of times BS option led to relevant items	NA	100%	NA	0	NA	100%	NA	100%	NA	100%
7. Patrons' selection of the browse general (BG) topics option	NA	2	NA	0	NA	0	NA	1	NA	3
a. Relevant items	NA	0	NA	0	NA	0	NA	0	NA	0
b. Percentage of times BG option led to relevant items	NA	0%	NA	0%	NA	0%	NA	0%	NA	0%
Percentage of times SA option led to relevant items (directly or through supporting options BF, BB, ST, SL, BS, or BG)	52%	23%	30%	27%	69%	26%	55%	49%	54%	32%

Table 63. Alphabetical Searches Directing Staff to Relevant Items

	LC SOC	LC DOC	NYSL SOC	NYSL DOC	PLCFC SOC	PLCFC DOC	UI SOC	UI DOC	Total (Four Libraries) SOC	Total (Four Libraries) DOC
1. Staff selection of the alphabetical (SA) search option	70	57	53	37	67	27	70	39	260	160
a. Relevant items	6	0	0	0	1	0	10	2	17	2
b. Percentage of times SA option led directly to relevant items	9%	0%	0%	0%	6%	0%	14%	5%	7%	1%
c. Percentage of times zero items retrieved	71%	100%	92%	100%	73%	100%	53%	92%	71%	98%
d. Percentage of times zero items retrieved when close matches are in the alphabetical list and are counted as matches	44%	63%	36%	65%	51%	78%	40%	38%	43%	60%
2. Staff selection of the browse forward (BF) option	7	0	2	0	1	0	3	0	13	0
a. Relevant items	3	0	2	0	1	0	1	0	7	0
b. Percentage of times BF option led directly to relevant items	43%	0%	100%	0%	100%	0%	33%	0%	54%	0%
3. Staff selection of the browse backward (BB) option	1	0	1	0	4	0	3	0	9	0
a. Relevant items	1	0	1	0	4	0	1	0	7	0
b. Percentage of times BB option led directly to relevant items	100%	0%	100%	0%	100%	0%	33%	0%	78%	0%
4. Staff selection of the select a topic (ST) from listed topics option	NA	2	NA	3	NA	1	NA	12	NA	18
a. Relevant items	NA	1	NA	2	NA	1	NA	8	NA	12
b. Percentage of times ST option led directly to relevant items	NA	50%	NA	67%	NA	100%	NA	67%	NA	67%

Table 63. Alphabetical Searches Directing Staff to Relevant Items (continued)

	LC SOC	LC DOC	NYSL SOC	NYSL DOC	PLCFC SOC	PLCFC DOC	UI SOC	UI DOC	Total (Four Libraries) SOC	Total (Four Libraries) DOC
5. Staff selection of the select line (SL) to display items option										
a. Selection of SL option in connection with the SA option	21	10	36	3	44	5	30	11	131	29
b. Selection of SL option in connection with the ST option	NA	0	NA	0	NA	1	NA	1	NA	2
c. Relevant items when selected with the SA option	13	6	28	0	27	3	25	8	93	17
d. Relevant items when selected with the ST option	NA	0	NA	0	NA	1	NA	1	NA	2
e. Percentage of times SL option led to relevant items	62%	60%	78%	0%	61%	67%	83%	75%	71%	61%
6. Staff selection of the browse specific (BS) topics option	NA	1	NA	0	NA	0	NA	1	NA	2
a. Relevant items	NA	1	NA	0	NA	0	NA	1	NA	2
b. Percentage of times BS option led to relevant items	NA	100%	NA	0%	NA	0%	NA	100%	NA	100%
7. Staff selection of the browse general (BG) topics option	NA	0	NA	0	NA	0	NA	0	NA	0
Percentage of times SA option led to relevant items (directly or through supporting options BF, BB, ST, SL, BS, or BG)	33%	14%	58%	5%	49%	19%	53%	51%	48%	22%

Approximately 28% of patron- and staff-entered terms matched an indexed subject heading. At NYSL, their difficulty making a letter-for-letter match might have been attributed to the abbreviations and punctuation in many subject headings in the NYSL database. For example, these searchers did not always include parentheses, hyphens, or the correct state name abbreviation for subject headings like "New York (State)--History" or "Lewiston, N.Y." in their entered terms; consequently, user-entered terms such as "New York State History" and "Lewiston, NY" were not counted as matches of subject headings.

In about 10% of online searches, staff consulted the printed LCSH, and patrons consulted the LCSH in even fewer searches. Thus, it is not too surprising that few searchers were able to match subject headings letter-for-letter because few searchers consulted the printed LCSH and few of their entered terms included correct punctuation and/or abbreviations.

Two user-entered terms in 152 alphabetical searches conducted by patrons matched a Relative Index entry in DOC; only three user-entered terms in 160 alphabetical searches conducted by staff matched a Relative Index entry. A computer-assisted construction of Relative Index entries was necessary to complete abbreviations and join together secondary entries to the main Relative Index entry or to another secondary entry (see section 4.3.3). This joining process was often responsible for introducing two hyphens between two words of an entry that made this construction unnatural. Examples of such Relative Index entries with hyphens in "unnatural" places are the following:

With "Unnatural" Hyphens	Without Hyphens in "Unnatural" Places
Small--businesses--management	Small businesses--management
Differential--topology	Differential topology
Target--shooting sports	Target shooting--sports
Unitary--spaces	Unitary spaces
Cayuga--County New York--history	Cayuga County--New York--history
Wall--displays--advertising operations	Wall displays--advertising operations
French--and Indian War--United States history	French and Indian War--United States--history

Given such "unnatural" entries, we can expect that few terms entered by library patrons and staff would be letter-for-letter matches of Relative Index entries.

Because few user-entered terms matched subject headings or Relative Index entries, most alphabetical searches initially resulted in zero items. However, both alphabetical searches in SOC and DOC responded to the user-entered term with an alphabetical list of ten subject headings or Relative Index entries that helped users find an appropriate heading or entry describing their topic of interest. Often, a close match of the user-entered term was among the listed headings or entries or among terms in the alphabetical lists preceding or following the initial display. We analyzed these close matches of user-entered terms in the alphabetical lists to determine the percentage of alphabetical searches resulting in zero items when close matches in alphabetical lists were counted as matches. (For example, the user-entered term "Lewiston, NY" was counted as a match of the subject heading "Lewiston, N.Y.") The result of this analysis was that the percentage of alphabetical searches resulting in zero items dropped dramatically. In SOC, 47% of patrons' alphabetical searches and 43% of staff alphabetical searches resulted in zero items when close matches were counted as matches. In DOC, 60% of patron and staff searches in DOC resulted in zero items. The latter is a marked improvement over the 99% of patrons' searches and 98% of staff searches which resulted in zero items when close matches were not counted as matches. Alphabetical lists of subject headings and Relative Index entries are valuable sources of subject terminology for browsing by patrons and staff once they have entered a term.

Patrons and staff who searched SOC employed options to browse forward (BF) or backward (BB) to see subject headings alphabetically before or after the initial list. On the whole, their efforts were rewarded because they retrieved relevant items between 48% and 78% of the times they used these options. DOC searchers infrequently used these browsing options. We attributed this infrequent use to the restriction of each participating library's database to one or two subject areas. In a list of ten Relative Index entries, there were few entries bearing the same main entry and one or two different secondary entries. Thus, there were few entries in a list that matched the user-entered term. Searchers needed to browse only the entries in the initial list of ten entries to determine whether their entered term or an appropriate term for their topic was in the list. In SOC, there were many subject headings bearing the same main term and different subdivisions. Thus, SOC searchers needed to browse the initial and successive or preceding lists to determine whether their entered term was in the list.

When patrons and staff selected subject headings or entries from the initial list, they employed the select lines to display items (SL) option. Fifty-five percent of the times patrons entered the SL option into SOC, they selected a subject heading assigned to relevant items. Staff entered the SL option in DOC and 61% of the time they selected a Relative Index entry or Schedule caption added to relevant items. In a total of 35 alphabetical searches conducted by patrons and staff, they called upon the ST option in DOC to display the logical lists or outlines composed of DDC Schedule captions. Over a third of these searches referred searchers directly to relevant items and another third were successful through the searcher's use of supporting options to select listed topic(s) or browse more specific topics, e.g., SL and BS options.

Overall and at individual libraries, both patrons and staff were more successful finding relevant items in alphabetical searches in SOC than in DOC. Nearly two of every four alphabetical searches in SOC resulted in the retrieval and display of relevant items. Three of every eleven alphabetical searches in DOC resulted in the retrieval and display of relevant items. However, the success of alphabetical searches in SOC and DOC was dependent upon the supporting options of each system that allowed searchers to browse subject headings and Relative Index entries because the searchers' track record of matching headings and entries was so low.

8.5.3 Successful Alphabetical Searches in SOC

The success of the alphabetical search in SOC was largely dependent upon users' ability to match the first word of their user-entered terms with an indexed subject heading(s) and their perseverance to browse the initial list and a preceding or following list(s) to find a subject heading(s) and/or a subject heading(s) with a subdivision(s) that described their topic of interest. For example, a patron whose topic of interest was "Black history of Albany, N.Y." found two relevant subject headings (on lines E and F) in the initial list of subject headings which was the system's response to the user-entered term "afro-americans in new york state":

```
>>>>> YOUR REQUEST...sa:afro-americans in new york state

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
  IF YOUR SUBJECT IS NOT LISTED, TRY ANOTHER SEARCH OPTION.
LINE ITEMS TOPICS--ASPECTS
   A     1 Adirondack Park, N.Y.--History
   B     1 Aeronautics--New York (City)--Accidents--1945
   C     1 Afro-Americans--Buffalo (N.Y.)--History
   D     2 Afro-Americans--New York (City)--History
   E     1 Afro-Americans--New York (State)--Albany--Bibliography
   F     1 Afro-Americans--New York (State)--Albany--History
   G     1 Afro-Americans--New York (State)--Bridgehampton--Pictorial
   H     1 Afton, N.Y.--History
   I     1 Agriculture--New York (State)--Orange County
   J     1 Albany Congress, 1754
```

Had the user first consulted LCSH, the two relevant subject headings in the above list would not have been explicitly listed among suggested subdivisions of the main subject heading "Afro-Americans. The term Indirect accompanying main subject headings refers to geographic subdivisions, but would not be understood by the majority (if not all) patron users of the library catalog. For the same user-entered term, DOC responds with a list of Relative Index entries that is limited to geographical areas, i.e., cities, counties, towns, rivers, and mountains, and does not include any entry beginning with the word "Afro":

```
>>>>> YOUR REQUEST...sa:afro-americans in new york state

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
  IF YOUR SUBJECT IS NOT LISTED, TRY ANOTHER SEARCH OPTION.
LINE ITEMS TOPICS--ASPECTS
   A    85 Adirondack Mountains New York--geography and travel
   B    70 Adirondack Mountains New York--history
   C    28 Albany--city--New York--geography and travel
   D   215 Albany--city--New York--history
   E     8 Albany--County--New York--geography and travel
   F   107 Albany--County--New York--history
   F     2 Allegany County--New York--geography and travel
   H    18 Allegany County--New York--history
   I    85 Ausable River New York--geography and travel
   J    70 Ausable River New York--history
```

Many SOC searchers benefited from the diversity and specificity of the alphabetical lists of subject headings. When they compared these lists with the alphabetical lists of Relative Index entries, they stressed the generality of the latter and specificity of the former. In a search for "Mathematicians," the SOC searcher obtained the following list of headings which contained form subdivisions and main headings that differentiated between mathematicians by country. Although the user said he was looking for information on

"Mathematicians," he entered the term "chinese" into the catalog twice, which implied that he was probably interested in Chinese mathematicians.

```
>>>>> YOUR REQUEST...sa:mathematicians

LINE ITEMS TOPICS--ASPECTS
   A      2 Mathematical--Philosophy
   B      1 Mathematical--Teaching--Switzerland
 * C     10 Mathematicians
   D      2 Mathematicians, German
   E      1 Mathematicians, Romanian
   F      1 Mathematicians--Biography
   G      1 Mathematicians--Correspondence
   H      7 Mathematicians--Correspondence, reminiscences, etc.
   I      1 Mathematicians--Directories
   J      1 Mathematicians--France
```

The user probably would not have been assisted in his search for "Mathematicians" by consulting LCSH. Although the subject heading "Mathematicians" was listed, it was accompanied by the Indirect designation which would have been meaningless to a patron searcher. The entry in LCSH for "Mathematicians" is the following:

```
Mathematicians (Indirect) (QA28-29)
  sa Actuaries
     English language--Conversation and phrase books (for mathematicians)
     Mathematics--Teacher training
     Mathematics--Vocational guidance
     Mathematics historians
     Mathematics teachers
     Women mathematicians
  xx Scientists
 --Correspondence, reminiscences, etc.
```

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In an alphabetical search for this same topic in DOC, there were no Relative Index entries beginning with "Mathematicians" and the closest entry in the alphabetical list to the user-entered term was the highly posted "Mathematics."

```
>>>>> YOUR REQUEST...sa:mathematicians

LINE ITEMS TOPICS--ASPECTS
   A     3 Martingales
   B    70 Mathematical--models--mathematics
    *** YOUR SUBJECT WAS NOT FOUND. PLEASE TRY ANOTHER SEARCH OPTION ***
   C  1640 Mathematics
   D    42 Matrixes--algebra
   E     8 Maxima--mathematics--calculus
   F    15 Maximal principle methods--calculus
   G     8 Mean--value theorems--calculus
   H     1 Means--statistical mathematics
   I    17 Measurable functions--spaces
   J    16 Measure theory--calculus
```

In an alphabetical search for "Teaching infants to swim," the SOC user benefited from the list of subject headings following the user-entered term "Swimming" where the headings "Swimming for children--Study and teaching" and "Swimming for infants--Study and teaching" described her topic. Selecting these headings, the user retrieved items entitled Teach your baby to swim, Watersafe your baby in one week, Infaquatics, and How to watersafe infants and toddlers. Relevant items were retrieved by the user's selection of the three subject headings in lines, D, E, and F:

```
>>>>> YOUR REQUEST...sa:swimming

LINE ITEMS TOPICS--ASPECTS
   A     1 Swamp camping
   B     1 Swamp camping--United States
 * C    59 Swimming
   D    13 Swimming for children
   E     1 Swimming for children--Study and teaching
   F     1 Swimming for infants--Study and teaching
   G     1 Swimming pools
   H     2 Swimming--Dictionaries
   I     1 Swimming--Juvenile literature
   J     1 Swimming--Rules--Yearbooks
```

In an alphabetical search for the same topic in DOC, the system responded to the user-entered term "swimming" with an alphabetical list of Relative Index entries that did not contain any entry beginning with the term "Swimming." As discussed in section 8.4.5 on subject outline searches, PLCFC often classed books in a classification number that was broader than the topics of certain books so that all the material on a topic would be found under one class number. In the case items on "Swimming," the library assigned the general class number "797.2 Swimming and diving" instead of the specific number "797.21 Swimming." In the processing of Relative Index entries into DOC, the entry "Swimming--sports" directed users to items with the class number 797.21, but this entry was deleted when Relative Index entries were processed into DOC for PLCFC because there were no books classed with 797.21.

In a search for "Women's coaching basketball," the patron performed an alphabetical search for "Basketball" and found a subject heading in the list "Basketball for women--coaching" that led her to relevant items on her topic. The alphabetical search in DOC listed only one entry, i.e., "Basketball--sports," that mentioned basketball, but the entry was too general to satisfy the user's topic of interest. The printed *LCSH* would not have been too helpful for directing the user to relevant subject headings because the suggested subdivisions do not mention "Coaching," and the "see also from" reference under "Basketball for women" directs the user to the heading "Sports for women" that is more general than the former heading and also does not suggest the subdivision "Coaching." The entries under "Basketball" and "Basketball for women" in *LCSH* are the following:

Basketball (*Indirect*) (GV885)
 sa Halfcourt basketball
  Korfball
  Netball
  subdivision Basketball *under names of universities, colleges, schools, etc. e.g.*, Harvard University--Basketball
 x Basket-ball
 --Biography
 --Defense
  x Defensive basketball
 --History
 --Offense
  x Offensive basketball
 --Records
  x Basketball players--Records
 --Refereeing
  See Basketball officiating
 --Rules
 --Societies, etc.
  sa Basketball clubs
 --Training

•

•

•

Basketball for women (GV886)
 x Girls' basketball
 xx Sports for women

Other alphabetical searches in SOC in which the user-entered term did not match a listed subject heading in the initial list of subject headings but the user was able to find an appropriate subject heading(s) in this list describing his topic of interest are the following:

Expressed Topic	User-entered Term	User-selected Subject Heading(s)
Aerobics	aerobics	Aerobic exercises
Detective movies	detective	Detective and mystery films; Detective and mystery films--History and criticism
Statistics	statistics	Statistics--Computer programs
Equine sports	horseback riding	Horsemanship; Horsemanship--Anecdotes, facetiae, satire, etc.
Jewish immigration to the U.S.	jewish immigrants	Jews in Brooklyn--Pictorial works; Jews in New York (City); Jews in New York (City)--History
Glens Falls, N.Y.	glens falls	Glens Falls, N.Y.--Description; Glens Falls, N.Y.--History; Glens Falls, N.Y.--Social life
Management of artists in theater or music	music employment	Music trade; Music trade--United States
Countertrade	countertrade	Counter trade
International capital flows	portfolio theory	Portfolio management--Addresses, essays, lectures; Portfolio management--Mathematic models

Patrons used the browsing options in SOC alphabetical searches to find suitable subject headings to express their topics of interest. Figure 45 shows a search for "Great baseball players." The system's response to the user-entered term "baseball" is a list of ten subject headings in which the last headings on the list indicate that there may be additional relevant headings on the next screen besides "Baseball players--Biography" and "Baseball players--United States." By entering the BF (browse forward) option, the searcher obtained subject headings such as "Baseball players--United States--Biography" that retrieved titles like *No big deal* by Mark Fidrych, *Balls* by Graig Nettles, and *Tom Seaver's all-time baseball greats*. In a DOC alphabetical search for the topic, there is only one entry under this topic, i.e., Baseball--sports. The entry "Baseball--players--biography and work" is not available for selection in DOC's alphabetical search because its class number 796.357092 has not been used by the library; thus, this entry was deleted from DOC when the DDC Online Project team processed Relative Index entries into the system.

```
Alphabetical Search in SOC                                 Explanation

What would you like to do? > sa

Enter subject to search > baseball                         The user enters the
                                                           term "baseball" into
                                                           SOC using
>>>>> YOUR REQUEST...sa:baseball                           the alphabetical
                                                           search.
```

Fig. 45. Alphabetical search in SOC for "Great Baseball Players" (cont. on next page)

```
LINE ITEMS TOPICS--ASPECTS
   A     1 Baryshnikov, Mikhail--1948-                            The subject headings
near
   B     2 Base running (Baseball)                                the end of the initial
list
 * C   118 Baseball                                               on lines I and J are
   D     8 Baseball coaching                                      relevant.
   E     1 Baseball for children--Training
   F     1 Baseball managers
   G     1 Baseball managers--United States--Biography
   H     2 Baseball managing
   I     1 Baseball players--Biography
   J     2 Baseball players--United States
   •
   •
   •
 What would you like to do? > bf                                  The user browses
                                                                  forward in the list of
                                                                  subject
>>>>> YOUR REQUEST...bf                                           headings.

LINE ITEMS TOPICS--ASPECTS                                        The first three
headings on
   A     2 Baseball players--United States                        lines A, B, and C and
last
   B    18 Baseball players--United States--Biography             heading on line J might
lead
   C     1 Baseball players--United States--Salaries, pensions, etc.    to relevant items.
   D     5 Baseball stories
   E     2 Baseball teams
   F     3 Baseball teams--History
   G     1 Baseball teams--United States
   H     1 Baseball--Addresses, essays, lectures
   I     6 Baseball--Anecdotes, facetiae, satire, etc.
   J     7 Baseball--Biography

OPTION  DESCRIPTION
    BF  Browse forward in alphabetical list
    BB  Browse backward in alphabetical list
    SD  Search directly for "baseball"
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > sl b                                 The user selects the
                                                                  heading "Baseball
                                                                  players--United
>>>>> YOUR REQUEST...sl b                                         States--Biography" and
      18 ITEMS IN SET 1  (Baseball players--United States--Biography)  displays a number of
                                                                  relevant items.
ITEM 1 OF 18
CALL NUMBER      796.357 R66zt
TITLE            Baseball's great experiment : Jackie Robinson and his legacy
LC SUBJECT       Robinson, Jackie--1919-1972
                 Baseball players--United States--Biography
                 Baseball--United States--History
                 United States--Race relations
AUTHOR           Tygiel, Jules.
PUBLISHER        New York : Oxford University Press, 1983.
```

Fig. 45. Alphabetical search in SOC for "Great Baseball Players" (cont. on next page)

```
Would you like to see the next item? ("RETURN"=yes, N=no) >

ITEM 2 OF 18
CALL NUMBER     796.357/A646b, 1980
TITLE           Baseball's best : the Hall of Fame Gallery
LC SUBJECT      Cooperstown, N.Y. National Baseball Hall of Fame and Museum
                Baseball players--United States--Biography
AUTHOR          Appel, Martin, 1948-
                Goldblatt, Burt
EDITION         Updated 1980 ed.
PUBLISHER       New York : McGraw-Hill, c1980.

Would you like to see the next item? ("RETURN"=yes, N=no) >

   •
   •
   •
```

Fig. 45. Alphabetical search in SOC for "Great Baseball Players" (continued)

The alphabetical search in SOC was helpful to a searcher performing a search for "Technology transfer to developing countries," because the user was able to match the first part of this query, i.e., technology transfer, with the subject heading "Technology transfer." Then, the user browsed the list of subdivisions under the main heading to find ones that referred to developing countries. For example, the subject headings "Technology transfer" with the subdivisions "--Asia," "--Developing countries," and "--Indonesia" selected in the alphabetical search shown in fig. 46 retrieved items entitled *International subcontracting: a tool of technology transfer*, *Technology transfer to developing countries*, *Agrotechnology transfer in Indonesia and the Philippines*, and *Technology transfer and development: India's Hindustan Machine Tools Company*. The printed LCSH entry under the subject heading "Technology transfer" would not have helped the user find subdivisions naming geographical areas, but the "see also" and "see also from" references might have suggested other subject headings to represent the concept of technology transfer:

Technology transfer (T174.3)
   sa Foreign licensing agreements
      New products
      Nuclear nonproliferation
      Technological forecasting
      Technological innovations
      Technology--International cooperation
    x Technological transfer
      Transfer of technology
   xx Diffusion of innovations
      Foreign licensing agreements
      Inventions
      Research, Industrial
      Technological forecasting
      Technological innovations
      Technology--International cooperation

An alphabetical search for this same topic in DOC was not successful because there were no Relative Index entries to express "Technology transfer." The user relied on the direct search in DOC to retrieve and display relevant items on this topic.

Alphabetical Search in SOC

Explanation

```
What would you like to do? > sa
Enter subject to search > technology transfer

>>>>> YOUR REQUEST...sa:technology transfer
```

The user enters the term "technology transfer" into SOC using the alphabetical search.

```
* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER FOR YOUR SUBJECT.

LINE ITEMS TOPICS--ASPECTS
   A     1 Technology assessment--Economic aspects--United States
   B     1 Technology assessment--United States--Congresses
 * C     9 Technology transfer
   D     2 Technology transfer--Addresses, essays, lectures
   E     1 Technology transfer--Asia
   F     1 Technology transfer--Austria
   G     1 Technology transfer--Canada--Addresses, essays, lectures
   H     1 Technology transfer--Communist countries
   I     8 Technology transfer--Congresses
   J     2 Technology transfer--Developing countries

   •
   •
   •
```

The user scans subdivisions of the main term "Technology transfer" to find one(s) appropriate to the developing countries of interest to him. Selecting line E "Technology transfer --Asia" retrieves International sub-contracting: a tool for technology transfer.

```
>>>>> YOUR REQUEST...bf

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER FOR YOUR SUBJECT.

LINE ITEMS TOPICS--ASPECTS
   A     2 Technology transfer--Developing countries
   B     1 Technology transfer--Developing countries--Congresses
   C     2 Technology transfer--Europe, Eastern
   D     1 Technology transfer--Europe--Congresses
   E     1 Technology transfer--Government policy--United States
   F     1 Technology transfer--Great Britain
   G     1 Technology transfer--History--Congresses
   H     2 Technology transfer--India
   I     2 Technology transfer--Indonesia--Congresses
   J     2 Technology transfer--Japan--Congresses

   •
   •
   •
```

The user browses forward in the alphabetical list of subject headings. Selecting line A "Technology transfer --Developing Countries" retrieves Transfer of technology among developing countries and Technology transfer to developing countries.

Fig 46. Alphabetical Search in SOC for "Technology Transfer to Developing Countries" (cont. on next page)

```
>>>>> YOUR REQUEST...bf

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER FOR YOUR SUBJECT.

LINE ITEMS TOPICS--ASPECTS
   A     2 Technology transfer--Japan--Congresses
   B     1 Technology transfer--Korea (South)--Congresses
   C     1 Technology transfer--Latin America--Case studies
   D     1 Technology transfer--New Mexico
   E     1 Technology transfer--Philippines
   F     1 Technology transfer--Philippines--Congresses
   G     4 Technology transfer--Soviet Union
   H     6 Technology transfer--United States
   I     1 Technology transfer--United States--Congresses
   J     1 Technology transfer--Yugoslavia

   o
   o
   o

What would you like to do? > sl c
```

The user browses forward for a second time. Headings with subdivisions "--Korea (south)," "--Latin America," and "--Philippines" may lead the user to relevant items.

```
>>>>> YOUR REQUEST...sl c
       1 ITEM IN SET 2  (Technology transfer--Latin America--Case studies)

ITEM 1 OF 1
DEWEY NUMBER     338.91098
LC CALL NUMBER   HD62.47 .073 1982
TITLE            Organizational forms of transfer of technology to
                 developing countries by small and medium-sized
                 enterprises : a case study of equity joint ventures
                 and technology agreements in Latin America
LC SUBJECT       Joint ventures--Latin America--Case studies
                 Small business--Latin America--Technological innovations--Case
                 studies
                 Technology transfer--Latin America--Case studies
AUTHOR           White, Eduardo.
                 Feldman, Silvio.
                 United Nations Conference on Trade and Development.  Secretariat.
                 United Nations Conference on Trade and Development.  Committee
                 on Transfer of Technology.
PUBLISHER        Geneva : United Nations, 1982.
```

The user selects the heading with "--Latin America" as a subdivision and displays the one item retrieved.

Fig. 46. Alphabetical Search in SOC for "Technology Transfer to Developing Countries" (continued)

Other alphabetical searches in SOC, in which the user-entered term did not match a listed subject heading in the initial list of subject headings but the user was able to find an appropriate heading(s) describing his topic in list(s) preceding or following the initial list of subject headings, are the following:

Expressed Topic	User-entered Term	User-selected Subject Heading(s)
How to invest in the stock market	investment	Investment clubs--Handbooks, manuals, etc.
Motivating employees	employees	Employee motivation; Employee motivation--United States
Indians	indians	Indians of North America--New York (State); Indians of North America--New York (State)--Wars; Indians of North America--New York (State)--Antiquities
Racquetball	raquetball	Racquetball
Graphing polar coordinates	graphing	Graph theory--Problems, exercises, etc.
Sets and set theory	sets and set theory	Set theory
Chinese economics	china standards of living	China--Economic conditions--1949-; China--Economic conditions--1976-; China--Social conditions--1976-
Founding and early history of Buffalo, N.Y.	buffalo n.y.	Buffalo, N.Y.--History

Browsing the alphabetical lists enabled users not only to find an appropriate subject heading describing their topic of interest, but to find the appropriate subject heading when they misspelled their term (raquetball) or to find a suitable subdivision (China--Economic conditions) or to focus on a more specific aspect of their topic of interest (Indians of North America--New York (State)--). These alphabetical lists of subject headings contained specific names of people (in searches for "Dewitt Clinton," and "Thomas Jefferson"), a combination of topical and geographic headings (in searches for "American Corporations in South Africa," and "Economic development in the Soviet Union"), and, frequently, two or more topics in a single heading (in searches for "Cost of medical care in the United States," "Computers as an aid to mathematical Statistics," and "Jewish immigration to the U.S.").

- The list of subject headings allows me to browse and choose needed terms. The direct search is not as stimulating in comparison. (one staff, LC)

- It is easy to search alphabetically because the result gives you an idea of other topics for expressing your topic. (one staff, LC)

- The alphabetical search helps you find items even if you misspell a word. (one patron, LC; one staff, UI)

- The alphabetical search helps you find a word or phrase you wouldn't normally have thought of. (one patron, LC)

- I saw a listed term ("Soccer for children") and decided this was closer to what I wanted than what I'd entered into the catalog ("Soccer"). (one patron, PLCFC)

In post-search interviews, library patrons and staff noted the specificity of main subject headings and subdivisions. In comparisons with the alphabetical list of Relative Index entries, patrons and staff felt that subject headings were more specific than Relative Index entries and preferred the specificity of the former to the generality of the latter. Online retrieval test participants' remarks about the specificity of subject headings are too numerous to include all but a few representative comments:

- The listed terms in SOC were more precise than DOC's terms. SOC gives "little itty-bitty topics" in comparison to DOC. (one patron, UI)

- SOC's alphabetical list of subject headings and subdivisions were like a list of "related topics" from which I chose a topic I needed. (one staff, PLCFC)

- SOC's list of subject headings and subdivisions lets you find specific aspects of a broad topic to narrow the search. (one staff, NYSL)

- SOC's list of subdivisions provided greater detail for my subject ("History of printing in Schenectady") and greater discrimination about an item's contents. SOC gave me 18 subdivisions; DOC gave only 2. (one patron, NYSL)

- DOC's list of alphabetically arranged entries were not as specific or as precise as SOC's list of subject headings. (one staff, LC; four patrons, NYSL; three staff, NYSL; one staff, PLCFC; ten patrons, UI)

- SOC's list of subject headings allowed me to find subdivisions to narrow my topic. DOC's entries were too broad and there was no way to narrow my topic. (one patron, NYSL)

8.5.4 Need for Related Terms in Alphabetical Searches

Online retrieval test participants liked the specificity of the lists of alphabetically arranged subject headings. However, their experiences using these lists were not always satisfactory in finding items relevant to their topics of interest because they expected these lists to contain related terms to their entered term or wanted the system to generate lists of related terms upon their selection of a listed term. In a patron's search for "Women in U.S. colonial history," the searcher was pleased by the alphabetical list of subject headings in SOC. Even though her topic was not specifically mentioned in the list, there were main subject headings that matched the initial word of the user-entered term and gave the user the idea that the database did not contain any information on her topic of interest. The user-entered term "women in col history" resulted in the following list of subject headings:

```
>>>>> YOUR REQUEST...sa:women in col history

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
  IF YOUR SUBJECT IS NOT LISTED, TRY ANOTHER SEARCH OPTION.
LINE ITEMS TOPICS--ASPECTS
   A     3 Wolfe, James--1727-1759
   B     1 Women as mathematicians
   C     1 Women in literature and art
   D     2 Women in New York (City)
   E     1 Women--Biography
   F     1 Women--Legal status, laws, etc.--New York (State)--History
   G     1 Women--New York (City)
   H     1 Women--Social and moral questions
   I     2 Wood, Fernando--1812-1881
   J     1 Wood-engraving, American
```

Seven subject headings in the above list contain the word "Women" which was the initial word of the user-entered term. This same user-entered term was typed into DOC in an alphabetical search and the result was very different:

```
>>>>> YOUR REQUEST...sa:women in col history

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
  IF YOUR SUBJECT IS NOT LISTED, TRY ANOTHER SEARCH OPTION.
LINE ITEMS TOPICS--ASPECTS
   A    70 Whiteface Mountain New York--history
   B    12 Whitefish Bay Michigan--history
   C    14 Wyoming--County--New York--history
   D    11 Yates County New York--history
           --------------- END OF LIST --------------------
```

The user's reaction to this list of Relative Index entries was "Why should 'Whitefish Bay' be shown in a list for a search on 'Women in U.S. colonial history'?" This user's reaction was not unique and reflected the expectations of other SOC and DOC users who thought that the alphabetical list of subject headings or Relative Index entries was a list of related terms, i.e., terms that were related conceptually to the user-entered term. At the University of Illinois, patrons' reactions to alphabetical lists of subject headings were particularly marked by their expectation of related terms:

- I expected the system to be less literal than it was and understand my term (which was a mixture of misspelled words and abbreviations) and give me books matching what I am thinking about (in searches on "Theoretical mathematics" and "Integration by substitution of parts"). (two patrons, UI)

- I thought that the items message in the list meant that there were 31 terms narrower than the one listed. (one patron, UI)

- I thought that this list was composed of related terms. (one patron, UI)

Because of such reactions, we enhanced the message preceding the list of alphabetically arranged subject headings and option descriptions for BB and BF with the word "alphabetical." Thus, the display of subject headings and Relative Index entries at LC, NYSL, and PLCFC told the user in three places that this was an alphabetical list. However, comments comparable to the UI reactions were still obtained:

- I thought the list of subject headings in the alphabetical search was a list of related terms. So I kept entering BF (browse forward) to find a related term of interest (in searches for "Loyalists and tories" and "Women in U.S. colonial history"). (two patrons, NYSL)
- I didn't realize the list was an alphabetical arrangement until I saw the BB and BF message (in a search for "Fishing rod building"). (one patron, PLCFC)
- I couldn't see any connection between my topic ("Thomas Jefferson") and DOC's list of entries. (one patron, NYSL)
- I didn't know why the listed terms (in an alphabetical search in DOC) had nothing to do with the topic I entered into the catalog (in a search for "Basketball"). (one patron, PLCFC)

Many patrons and staff expressed the need for a list of related terms in response to their user-entered term:

- I want a list of related terms or capability for going from broad to specific topics. (four staff, LC; four staff, NYSL; one patron, NYSL; one patron, PLCFC)
- SOC gives you no assistance for finding related terms. (two staff, UI)
- SOC's list of subject headings should begin with the term I entered (in searches for "New Lebanon," "Employee relations," and "Employment in Britain") and list related terms. (one patron, NYSL; two patrons, LC)
- Alphabetical lists of subject headings are not as useful as cross references and related terms. (one staff, LC; six staff, UI)
- I want to see subject headings with my entered term (History) embedded in headings and not only in headings starting with my entered term (in a search for "Marketing at the turn of the century"). (one patron, LC)
- It takes a long time to find the right subject heading, especially without LCSH online. (two staff, UI)
- The alphabetical search is inefficient because it only provides an alphabetical list. (one patron, UI)

The staff search in SOC for the topic "What to see and do in New York City" failed to retrieve relevant items with the term "new york city." The main reason is the user's failure to include the correct punctuation in his term. Without the proper punctuation, the user-entered term placed the searcher in the alphabetical subject heading index after relevant subject headings describing the user's topic of interest. The searcher would have had to persevere in this search by repeatedly browsing backwards (BB option). The subject headings on lines F and G in the following alphabetical list would have retrieved items with titles such as *500 things to do in New York for free: and 100 things for less than a buck*, *Barron's seeing the real New York*, and *Free New York: 1500 free pleasures and entertainments and much, much more*.

```
>>>>> YOUR REQUEST...bb

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER FOR YOUR SUBJECT.

LINE ITEMS TOPICS--ASPECTS
   A     1 New York (City)--Description--1951--Addresses, essays, lectures
   B     1 New York (City)--Description--1951--Collected works
   C     6 New York (City)--Description--1951--Guide-books
   D     3 New York (City)--Description--1951--Tours
   E     3 New York (City)--Description--1951--Views
   F     3 New York (City)--Description--1981--Guide-books
   G     2 New York (City)--Description--1981--Tours
   H     1 New York (City)--Description--Anecdotes, facetiae, satire, etc.
   I    75 New York (City)--Description--Guide-books
   J     3 New York (City)--Description--Juvenile literature
```

Consulting the printed *LCSH* could have also helped the user find a relevant subject heading and subdivisions to describe his topic of interest. Under the main subject heading "New York (City)" are listed relevant subdivisions but no "see also" or "see also from" references describing this topic:

```
New York (City)
   •
   •
   •
 --Description
      Note under Geography
 -- --1951-

         GENERAL SUBDIVISIONS

 -- --Anecdotes, facetiae, satire, etc.
 -- --Guide-books
       Example under reference from Guide-books
 -- --Juvenile literature
     Maps
       See New York (City)--Maps
 -- --Underground areas
       See New York (City)--Underground areas
 -- --Views
       Example under Views
    •
    •
    •
```

The searcher who performed a search in SOC for "Indians" first entered the term "indians" into the catalog using a direct search and retrieved 191 items. Considering the number of items retrieved too many, the user followed with an alphabetical search for "indians" and obtained a list of subject headings such as "Indians of North America--New York (State)" and selected five headings beginning with this main heading and subdivision which led to relevant items. In this search, the alphabetical list of subject headings helped the user to narrow his topic of interest. The list of Indian tribes accompanying the main subject heading "Indians of North America" in LCSH as "see also" references could have also helped the user narrow his topic of interest by indicating that items on specific Indian tribes can also be found in the catalog. This list of tribes is lengthy and extends for 1 1/2 pages in the printed LCSH. Portions extracted from this list are the following:

Indians of North America (E77-99)
    Subdivided by states, provinces, regions, etc. e.g., Indians of North America--Massachusetts; Indians of North America--British Columbia; Indians of North America--Mississippi Valley. Cf. note under Indians.
  sa Abitibi Indians
    Abnaki Indians
    Achomawi Indians
    Acoma Indians
    Agua Caliente Indians
    Ahtena Indians
    Aleuts
    Algonkin Indians
    Algonquian Indians
    •
    •
    •
    Okinagan Indians
    Omaha Indians
    Oneida Indians
    Oneota Indians (Great Plains)
    Onondaga Indians
    Oohenonpa Indians
    Osage Indians
    Oto Indians
    Ottawa Indians
    Paiute Indians
    •
    •
    •
    Tuscarora Indians
    Tutelo Indians
    Tututni Indians
    Twana Indians
    Ugalakmiut Indians
    •
    •
    •

Following this list of "see also" references are 5 1/2 pages of suggested subdivisions to the main term "Indians of North America." Integrating such a long list of "see also" references and suggested subdivisions into the online catalog is not an easy task. Even in searches for "Football" or "Differential equations," in which the lists of "see also" references and suggested subdivisions are manageable in size, there is the challenge of integrating this information in *LCSH* with the subject heading and classification practice of the library and the subject information in the DDC. In section 9.5.2.2, we provide recommendations for such an integration.

A staff member's consultation of the printed *LCSH* in a search for "Food problems in third world countries, especially in Africa" helped him to identify relevant subject headings, but not ones that led to relevant items in alphabetical searches in SOC. The searcher first checked under "Famines" in *LCSH* and scanned the entry:

```
Famines (General HC63: By country,
        HC95-695; Relief agencies, HV630)
    sa subdivision Famines under names of
         certain countries, e.g., India--
         Famines, Ireland--Famines
    xx Food supply
       Starvation
```

The user then entered this subject heading into SOC. Retrieving zero items, the user entered "starvation" into SOC which was a "see also from" reference under "Famines." Retrieving zero items again, the user entered the terms "third world" and "africa" into the catalog, which were terms in the expressed topic. Had the user entered the heading "food supply" into SOC, which was the first of two "see also from" references under "Famines," the user would have retrieved this list of subject headings and subdivisions:

```
>>>>> YOUR REQUEST...sa:food supply

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER FOR YOUR SUBJECT.

LINE ITEMS TOPICS--ASPECTS
   A     1 Food relief--India--Tamil Nadu
   B     1 Food service
 * C     5 Food supply
   D     1 Food supply--Addresses, essays, lectures
   E     2 Food supply--Africa
   F     1 Food supply--Africa, Sub-Saharan--Addresses, essays, lectures
   G     1 Food supply--Africa, West
   H     1 Food supply--Asia
   I     1 Food supply--Asia, Southeastern--Congresses
   J     1 Food supply--Bangladesh
```

Selecting the three subject headings on line E, F, and G, the user would have retrieved items entitled *Food production in Africa*, *Developmental effectiveness of food aid in Africa*, and *Imperialism, colonialism and hunger: east and central Africa*. The user could have browsed forward in this list of subject headings and found ones with subdivisions naming countries in Africa, e.g., --Ethiopia,

--Nigeria, --Malawi, that could also have led to the retrieval of additional items.

8.5.5 Alphabetical Searches in DOC

In this discussion of alphabetical searches, we have shown that patron and staff searches often benefited from the specificity of the alphabetical lists of subject headings in SOC. In an alphabetical search for the same topic in DOC, usually one or two entries in the alphabetical list described one facet of the user's multifaceted topic of interest or described the user's topic in a broad or general way. For example the SOC searcher for "Investing in real estate" obtained a list of seven subject headings bearing the same main term "Real estate investment" and six different subdivisions:

```
>>>>> YOUR REQUEST...sa:real estate investment

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER FOR YOUR SUBJECT.

LINE ITEMS TOPICS--ASPECTS
   A     1 Real estate development--United States--Directories
   B     1 Real estate development--United States--History--20th century
 * C    47 Real estate investment
   D     1 Real estate investment--Case studies
   E     1 Real estate investment--Finance
   F     1 Real estate investment--France
   G     1 Real estate investment--Rates and tables
   H     3 Real estate investment--Syndication
   I     7 Real estate investment--United States
   J     7 Real estate listings
```

The DOC searcher for the same topic entered "Real estate management" into the online catalog and obtained a list of Relative Index entries of which "Real--property--economics--investments" best described the user's expressed topic. Whereas SOC listed seven headings of interest, DOC only listed two entries beginning with the phrase "Real estate."

```
>>>>> YOUR REQUEST...sa:real estate investment

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
  IF YOUR SUBJECT IS NOT LISTED, TRY ANOTHER SEARCH OPTION.
LINE ITEMS TOPICS--ASPECTS
   A     4 Railroad--companies--investment in--financial economics--dom
   B    15 Rates (percentages)--property taxes--public finance
   C    52 Real--property--economics
   D    18 Real--property--economics--credit
   E    37 Real--property--economics--investments
   F     3 Real--property--market
   G    18 Real-estate--finance--economics
   H     4 Real-estate--investment trusts
   I     1 Receiving--operations--materials management
   J    17 Recessions--economic cycles--production economics
```

Selecting line E, the user retrieves titles such as *Success strategies for investment real estate*, *The smart investor's guide to real estate*, and *How you can build a fortune investing in residential real estate*. These titles have the class number 332.6324 in common; thus, the DOC user seeking these titles on the shelf has the advantage of arriving at a shelf location where there will probably be a number of items on this topic. The SOC searcher who selects a subject heading in an alphabetical search cannot be guaranteed that he will always be directed to a shelf location where there will be other items on his topic.

The alphabetical search in DOC was particularly effective, because it referred the searcher to one shelf location. When many items were assigned a particular subject heading, these items were often scattered throughout the library's bookshelves. For example, the subject heading "Small business--Management" best described the user's topic of interest "Starting a small business." The number of items bearing the subject heading "Small business-Management" as the first-listed heading in the item and their class numbers are the following:

Number of Items	Class Number
16	658.022
2	658.1592
1	658.04
1	658.42
1	658.155
1	338.642

Browsing the shelves under the class number 658.022 would probably be the best strategy for the searcher. At that number, he would find items entitled *Starting and managing a small service business*, *Diary of a small business*, and *Starting and managing a small business of your own that do not contain the subject heading "Small business--management"* along with titles such as *Starting and managing the small business* and *How to start your own small business that do contain the subject heading "Small business management."* In an alphabetical search in DOC, the user selecting the entry "Small--businesses--management" on line D retrieves 37 items bearing the class number 658.022 which is the shelf location where there are relevant items on "Starting a small business" including the titles cited above.

```
>>>>> YOUR REQUEST...sa:small business

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
  IF YOUR SUBJECT IS NOT LISTED, TRY ANOTHER SEARCH OPTION.
LINE ITEMS TOPICS--ASPECTS
   A     1 Sit-down strikes--labor economics
   B     3 Slogans--advertising operations
   C     4 Small--businesses--investment in--financial economics
   D    37 Small--businesses--management
   E     9 Small--businesses--management--financial
   F     1 Small--businesses--management--personnel
   G    77 Small--businesses--production economics
   H    77 Small--industries--production economics
   I     3 Small-business loans--economics
   J     8 Social--justice school--economics
```

Other alphabetical searches in which users were also able to match their entered term with a Relative Index entry and retrieve relevant items are the following:

Expressed Topic	User-entered Term	User-selected Relative Index Entry
Multinational corporations	multinational corporations	Multinational--business organizations--production economics
How to invest in the stock market	stock i	Stock--options--investment finance
Corporate social responsibility	social	Social--responsibility--management
Bridge	bridge	Bridge (game)--recreation
Time series analysis	time series analysis	Time-series--analysis--mathematical statistics
Geography of Columbia County, N.Y.	Columbia county geography	Columbia--County--New York--geography and travel
Analytic number theory	analytic number theory	Analytic--number theory
Betting on the horses	betting on horses	Betting--horse racing
Dictionaries for completing crossword puzzles	crossword puzzles	Crossword puzzles--recreation

When the user was able to find a Relative Index entry describing his topic of interest in DOC's alphabetical search, the user was directed to one classification area where there were relevant items. However, users preferred the specificity of subject headings to the generality of Relative Index entries and criticized the latter for being so broad and creating sets of retrieved items that covered their topic of interest and other unwanted topics:

- The categories were too broad for pinpointing items on my topic ("Numerical methods"; "Double integrals"). (two patrons, UI)

- I didn't continue searching for my original topic ("Camping vehicles") because this list (of Relative Index entries) does not contain my topic. (one patron, PLCFC)

- DOC needs a more specific breakdown of topics within the broad topics listed. (four staff, PLCFC)

- SOC's alphabetical list contains both topical and geographical headings. DOC's list only contains geographical entries. (one staff, NYSL; two patrons, NYSL)

- I found it difficult to find the two concepts of my topic expressed in a Relative Index entry (in a search for "Development economics"). (one patron, LC)

A few searchers at LC felt that the list of Relative Index entries were specific to their topics of interest and cited other positive aspects of alphabetical searching in DOC:

- The entries in DOC's alphabetical search were more specific to my topic than the subject headings in SOC (in searches for "Investment" and "Employee relations"). And the entries in DOC told me what shelf areas to browse. (two patrons, LC)

- DOC's alphabetical search gave me an indication of everything on my topic in one alphabetical list whereas SOC's list scrolled off the screen. (one patron, LC)

- I found it handy to select the ST (search subject outline for a listed topic) option in the menu because the alphabetical entries just lead to bibliographic records. (one staff, LC)

The ST (search subject outline for a listed topic) option was seldom used by online searchers in retrieval tests. But when it was selected by searchers as an option following the display of Relative Index entries, searchers felt that it placed the selected topic in context and provided them with an opportunity to browse topics more specific than those listed. For example, the user who was searching for "Investing in real estate" using the alphabetical search shown earlier could have selected the Relative Index entry "Real--property--economics--investments" to display items. Or, the user could have selected this entry to place it in context with other topics where items bearing this class number would be shelved. In the display below, the user has chosen the Relative Index entry "Real--property--economics--investments" using the ST option and a List of Topics is displayed:

```
>>>>> YOUR REQUEST...st e

ITEMS ON YOUR SUBJECT ARE FOUND UNDER 332.6324 IN THIS OUTLINE OF RELATED
SUBJECTS.

GENERAL TOPIC : 332.632 Securities and commodities
    LINE  ITEMS  AREA             TOPIC
       A      8  332.6320         General aspects. Examples: Journals, Study
       B     36  332.6322         Stocks
       C     23  332.6323         Bonds
*      D     56  332.6324         Real estate
       E     14  332.6327         Investment company securities
       F      5  332.6328         Commodities
```

Entering the BS (browse specific topics) option, the user would have obtained another List of Topics more specific than the one just listed:

```
>>>>> YOUR REQUEST...bs d

GENERAL TOPIC : 332.6324 Real estate
    LINE  ITEMS  AREA             TOPIC
       A      2  332.63242        Land
       B     11  332.63243        Buildings and other fixtures
       C      2  332.63244        Mortgages
       D      4  332.63247        Real estate investment trusts
```

A few searchers used this ST option which directed them from the alphabetically arranged Relative Index to the logical arrangement of the DDC Schedules. UI searchers' remarks about this capability were positive ones:

- The subject outline (obtained through the ST option) provided context for the selected topic. (one staff, UI)

- The subject outline (obtained through the ST option) provided me with a "more" complete list of subjects than SOC. (one staff, UI)
- The ST option gives subtopics for the one chosen. It is a better presentation of information than DOC's alphabetical search. (one patron, UI)

In an alphabetical search for "Traveling on the St. Lawrence River," two Relative Index entries were listed. "Saint--Lawrence--River--New York--geography and travel" retrieved 26 items, and "Saint--Lawrence--River--New York--History" retrieved 6 items. The first entry also directed searchers to class number "917.4756 Geography of and travel in St. Lawrence County" and 26 items; the second entry directed searchers to class number "974.756 History of St. Lawrence County" and 6 items. However, not one of the total 32 items was about the St. Lawrence River. Instead, alphabetical and direct searches in SOC for "st. lawrence river" retrieved titles such as Thousand Islands and the river St. Lawrence views, Souvenir of the Thousand Islands and river St. Lawrence, and Thousand Islands and St. Lawrence River bearing class numbers "917.4758 Geography of and travel in the Thousand Islands" and "974.758 History of the Thousand Islands." Because of the discrepancy between items classed in two class numbers and the Relative Index entry directing searchers to two different numbers, relevant items on the St. Lawrence River could not be retrieved using DOC's alphabetical or subject outline searches.

Similarly, there were Relative Index entries that retrieved items whose titles, subject headings, or other subject-rich information did not specifically cite the topic represented by the Relative Index entry. For example, the following entries in DOC at UI retrieved items with a particular class number but none of the subject-rich information in retrieved items, e.g., title, subject headings, DDC caption, specifically mentioned the topic represented by the entry:

Relative Index Entry/Class Number	Number of Items Retrieved
Indices (512.72)	12
Diophantine inequalities (512.73)	9
Cayley algebra (512.53)	4
Homeomorphisms--topology (514)	39
Denjoy integrals (515.43)	23
Quadratic--programming--mathematics (519.76)	6

All of these Relative Index entries were also listed in Schedule example, class here, or including notes. The DDC Online Project team discarded Relative Index entries when the class number of the entry was not contained in the library's bibliographic records. We did not discard entries whose class numbers matched bibliographic records' class numbers, but the records did not describe the subject of entries. This would have entailed searching DOC for the subject of every Relative Index entry and judging whether retrieved items contained the subject of entries. Even though the bibliographic record might not specifically mention the subject of the entry, an item's contents might contain information described by the entry.

8.5.6 Summary

Alphabetical searches in SOC and DOC required supporting options for browsing alphabetical terms and/or browsing logical lists of topics linked to the alphabetical terms. Few patrons and staff made letter-for-letter matches of indexed subject headings and Relative Index entries, but they called upon supporting options to select and/or browse listed headings and entries. Their matching efforts were hampered by not including correct punctuation, abbreviations, and hyphenation in their entered terms. Because of the displays of indexed headings and entries in the alphabetical neighborhood of the user-entered term, 53% of patron-entered terms in SOC and 57% of staff-entered terms in SOC and 40% of both patron- and staff-entered terms in DOC were close matches of a listed heading or entry with one or more retrievals. Even though user-entered terms were not exact matches of subject headings and Relative Index entries, the alphabetical list and supporting options provided searchers with the opportunity to find and select a heading(s) or entry(ies) that was a close match. But the success of the alphabetical search in SOC and DOC was largely dependent upon users' ability to match the first word of their entered-term with an indexed subject heading(s) or entry(ies) and their perseverance to browse the alphabetical list(s) of subject headings or entries for suitable terms describing their topics of interest.

Overall, SOC's alphabetical search directed the user to relevant items in a greater percentage of searches than DOC's alphabetical search. Patrons and staff noted the specificity of lists of subject headings in which main headings and subdivisions often exceeded the initial screen. In contrast, lists of Relative Index entries rarely contained one or two headings which matched the initial word of the user-entered term and searchers remarked on the generality of Relative Index entries. SOC searchers frequently called upon the browsing forward and backward options to display additional subject headings and subdivisions. The alphabetical lists of subject headings not only helped users match their entered terms with indexed subject headings, but the lists helped them to find headings when they misspelled their entered term, to focus on a specific aspect of a broad topic, or to survey the scope and contents of the database. Subdivisions of main headings were particularly helpful for narrowing users' original expressed topics.

Some searchers thought that the list of subject headings in alphabetical searches were lists of related terms to the user-entered term. These searchers and others (who recognized that the lists of subject headings were an alphabetical arrangement) expressed a need for related terms and cross references in the catalog. Examples of unsuccessful alphabetical searches that would have benefited from the inclusion of the printed LCSH in SOC were provided in this discussion; however, there were a number of alphabetical searches in which LCSH could not have helped the user because "see also" and "see also from" references were broader than the user's topic of interest, suggested subdivisions contained no such references, and/or geographical subdivisions were not listed among the suggested subdivisions (but were designated by the Indirect reference adjacent the main heading--a designation familiar and understandable to librarians and not to patrons).

There were successful alphabetical searches in DOC when there was a Relative Index entry describing the user-entered term or one facet of the user-entered term. The main benefit of DOC's alphabetical search was its ability to direct the user to one shelf area where there were items on the user's topic of interest. This was especially helpful when items assigned a subject heading describing the same topic were classed in a number of different areas and the user found a suitable Relative Index entry which directed him to one class number area of interest. DOC's alphabetical search also had the capability to direct users from the alphabetical lists of Relative Index entries to the logical lists of DDC Schedule captions where they were able to browse listed topics or topics more specific than those listed and find relevant items.

The specificity of alphabetical searches in SOC and generality of alphabetical searches in DOC had certain strengths and drawbacks. In section 9.5.2.2, we suggest how to integrate these two lists of headings and entries into a single list and to enhance them with LCSH and the classification practice of the library.

8.6 Call Number Searches

In call number searches in SOC, the system responded with the number of items in the database bearing the user-entered call number or beginning with the entered call number. Thus, the user-entered call number 796.33 retrieved items assigned 796.33 and 796.332. In call number searches in DOC, the system responded with a List of Topics constructed around the user-entered call number. For example, the user-entered call number 796.33 triggers a DOC response of DDC class numbers, Schedule captions, and number of items retrieved per caption for a range of captions from 796.30 to 796.39.

Tables 64 and 65 list the numbers and percentages of times patrons and staff entered call numbers in searches and were directed to relevant items. Generally, call number searches were more frequent in SOC than in DOC, but this frequency could be attributed to the availability of only three subject searching options in SOC and four subject searching options in DOC. That is, SOC searchers only had three subject searching options from which to choose so they selected the call number more frequently in SOC to complete the online search.

The percentage of times that UI staff retrieved zero items in SOC call number searches was unusually high. A number of staff searchers entered a specific call number of a relevant item they had retrieved and displayed in a direct and/or alphabetical search. The result of this call number search often resulted in zero items because SOC's call number search at UI carried out call number searches on only call numbers enumerated in the 19th edition of the DDC Schedules. When UI staff pointed out to us that they had been unable to retrieve a class number obtained from a retrieved relevant item in SOC, the call number search was changed in SOC for LC, NYSL, and PLCFC so that the entire DDC number (i.e., not a DDC number truncated according to the 19th edition of the DDC Schedules) was indexed in SOC's call number search (see also section 5.6.5, item 4). The postings still included all items whose DDC class numbers started with the user-entered call number.

Table 64. Call Number Searches Directing Patrons to Relevant Items

	LC SOC	LC DOC	NYSL SOC	NYSL DOC	PLCFC SOC	PLCFC DOC	UI SOC	UI DOC	Total (Four Libraries) SOC	Total (Four Libraries) DOC
1. Patron's selection of the call number (SC) search option	24	7	8	7	6	6	18	8	56	28
a. Relevant items	4	0	3	0	0	1	3	1	10	2
b. Percentage of times SC option led directly to relevant items	17%	0%	38%	0%	0%	17%	17%	13%	18%	7%
c. Percentage of times zero items retrieved	8%	0%	25%	29%	33%	33%	11%	13%	14%	18%
2. Patrons' selection of the select lines to display items (SL) option	NA	1	NA	1	NA	1	NA	2	NA	5
a. Relevant items	NA	1	NA	1	NA	1	NA	0	NA	3
b. Percentage of times SL option led directly to relevant items	NA	100%	NA	100%	NA	100%	NA	0%	NA	60%
3. Patrons' selection of the browse specific topics (BS) option	NA	2	NA	1	NA	2	NA	2	NA	7
a. Relevant items	NA	0	NA	1	NA	1	NA	0	NA	2
b. Percentage of times BS option led directly to relevant items	NA	0%	NA	100%	NA	50%	NA	0%	NA	29%
4. Patrons' selection of the browse more general topics (BG) option	NA	0	NA	1	NA	2	NA	0	NA	3
a. Relevant items	NA	0	NA	0	NA	0	NA	0	NA	0
b. Percentage of times BG option led directly to relevant items	NA	0%	NA	0%	NA	0%	NA	0%	NA	0%
Percentage of times SC option led to relevant items (directly or through supporting options SL, BS, or BG)	17%	14%	38%	29%	0%	50%	17%	13%	18%	25%

Table 65. Call Number Searches Directing Staff to Relevant Items

	LC	LC	NYSL	NYSL	PLCFC	PLCFC	UI	UI	Total (Four Libraries)	
	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC	SOC	DOC
1. Staffs' selection of the call number (SC) search option	22	11	10	12	22	13	36	15	90	51
a. Relevant items	5	0	5	2	6	3	7	3	23	8
b. Percentage of times SC option led directly to relevant items	23%	0%	50%	17%	27%	31%	19%	20%	26%	16%
c. Percentage of times zero items retrieved	0%	18%	10%	25%	5%	0%	39%	0%	18%	10%
2. Staffs' selection of the select lines to display items (SL) option	NA	2	NA	2	NA	3	NA	0	NA	7
a. Relevant items	NA	2	NA	0	NA	2	NA	0	NA	4
b. Percentage of times SL option led directly to relevant items	NA	100%	NA	0%	NA	67%	NA	0%	NA	57%
3. Staffs' selection of the browse specific topics (BS) option	NA	4	NA	0	NA	6	NA	0	NA	10
a. Relevant items	NA	3	NA	0	NA	3	NA	0	NA	6
b. Percentage of times BS option led directly to relevant items	NA	75%	NA	0%	NA	50%	NA	0%	NA	60%
4. Staffs' selection of the browse general topics (BG) option	NA	0	NA	0	NA	1	NA	0	NA	1
a. Relevant items	NA	0	NA	0	NA	0	NA	0	NA	0
b. Percentage of times BG option led directly to relevant items	NA	0%	NA	0%	NA	0%	NA	0%	NA	0%
Percentage of times SC option led to relevant items (directly or through supporting options SL, BS, or BG)	23%	45%	50%	17%	27%	62%	19%	20%	26%	35%

Overall, patrons and staff were more successful retrieving relevant items in call number searches in DOC than in SOC. The SL and BS options were the most helpful of the supporting options in DOC that directed searchers to relevant items.

Class numbers entered in both SOC and DOC searches by library patrons and staff had usually been obtained by searchers in retrieved records that they had displayed in alphabetical, direct, or subject outline searches prior to the call number search. Fig. 47 shows the highlights of a call number search in SOC in which the user first performed a direct search for "New Lebanon," retrieved six items, and displayed five of the six items. Three of these five displayed items were assigned the class number 974.739, which the user then entered in a call number search and retrieved and displayed additional items which she judged relevant to her genealogical research. The searching strategy undertaken by the user in this call number search is exactly the same as the call number searching strategy described in chapter 2 and shown in fig. 2 for an existing online catalog (LCS at The Ohio State University Libraries). Both LCS and SOC did not feature online displays of the DDC Schedules and Relative Index. However, call number searching in DOC, which featured the DDC Schedules and Relative Index, was successful when the searcher had previously identified a DDC class number of interest from the results of an alphabetical, direct, and/or subject outline search. Successful call number searches in the experimental online catalog in which this strategy of identifying a DDC class number of interest from items displayed in a previous search are the following:

Expressed Topic	Subject Search in Which Number Identified/System/User	User-entered Class Number/ Caption in DOC
Steuben County, N.Y.	Direct/SOC/Patron	974.783 History of Steuben County
King Philip's War	Alphabetical/SOC/Staff	973.24 Later 17th century, 1664-1689
19th century families living in Niagara County or Niagara Falls (city)	Direct/SOC/Staff	974.798 Niagara County
Pequot War	Subject outline/DOC/Staff	973.22 Other early settlements, 1620-1643
Business etiquette	Direct/SOC/Patron	658.452 Oral
Combinatorial analysis	Alphabetical/SOC/Patron	511.6 Combinatorial analysis
Incompleteness theorem	Subject outline/DOC/Patron	511.3 Symbolic (mathematical logic
Rings	Direct and alphabetical/ SOC/Staff	512.4 Rings integral domains ideals
Bowling	Subject outline/DOC/Patron	794 Indoor games of skill
Affine geometry	Alphabetical/DOC/Staff	516.4 Affine geometry

Call Number Search in SOC

Explanation

```
Enter an option > sd
Enter subject to search > new lebanon

>>>>> YOUR REQUEST...sd:new lebanon
     3465 ITEMS FOR "new"
        8 ITEMS FOR "lebanon"
        6 ITEMS IN SET 1  (new lebanon)

  THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
  SET  ITEMS    REQUEST
    1      6    sd:new lebanon

OPTION  DESCRIPTION
    SA  Search alphabetically for "new lebanon"
    DI  Display items
    SO  Start over

Enter an option > di

>>>>> YOUR REQUEST...di 1

    •
    •
    •
```

The user performs a direct search for "new lebanon" and retrieves 6 items.

```
ITEM 3 OF 6
DEWEY NUMBER    974.739qN53s
COLLECTION      H
TITLE           Marriages in New Lebanon, New York [performed by] Rev. Silas
                Churchill, 1795-1851 [and Ira Hand, esq., justice of the
                peace, 1832-1852].
AUTHOR          Shepard, Elmer Irwin 1878-
PUBLISHER       1943

    •
    •
    •
```

Three of the five items displayed and judged relevant contain the class number 974.739. One relevant item is shown here.

```
Enter an option > sc
Enter call number > 974.739

>>>>> YOUR REQUEST...sc:974.739
      102 ITEMS IN SET 2  (974.739)

  THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
  SET  ITEMS    REQUEST
    1      6    sd:new lebanon
    2    102    sc:974.739
```

The user enters 974.739 in SOC through the call number (SC) search and retrieves 102 items.

Fig. 47. Call number search in SOC for "New Lebanon, N.Y." (cont. on next page)

```
OPTION  DESCRIPTION
    DI  Display items
    SO  Start over


 Enter an option > di
Enter a set number to display > 2
   •
   •
   •
ITEM 9 OF 102
DEWEY NUMBER     974.739qAv21
COLLECTION       H
TITLE            Columbia County, New York, cemetaries: private and scattered.
AUTHOR           Van Alstyne, Harriet Huyck Kellogg 1875-
PUBLISHER        1938

Would you like to see the next item? ("RETURN"=yes, N=no) >

   •
   •
   •
```

The user displays 12 of the
102 items and judges most
of the 12 items relevant for her
genealogical research on "New
Lebanon" although these items
cover the entire county in
in which New Lebanon is
located.

Fig. 47. Call number search in SOC for "New Lebanon, N.Y." (continued)

In call number searches in both SOC and DOC, patrons and staff were well aware that they had to know the right call number to enter before proceeding with a call number search. Some even questioned the value of a call number search:

- The call number search in SOC is useless unless you know the right call number to enter into the catalog. (one patron, PLCFC)
- Why would anyone want to search for call number? (one patron, PLCFC)
- The call number search in SOC is difficult because you have to look at an item to find a candidate call number to enter. DOC leads you to call numbers through the SS (subject outline) search. (one staff, NYSL)
- When I entered a class number (650) into SOC, I didn't know what subject was covered by this number until I displayed items. (one patron, LC)
- To use DOC's call number (SC) search, you still need to know the meaning of the call number you want to enter into the catalog. (one patron, PLCFC; one staff, NYSL)

Patrons and staff recognized the difference between the call number searches in SOC and DOC and preferred DOC's call number search:

- SOC just provides you with the number of items on the call number. DOC provides you with a phrase for the call number and you can choose the phrase you like. (one staff, UI)
- DOC leads you to an outline of topics. I'd like this capability in SOC to help you know what a call number means. (two staff, PLCFC)

- I found a call number area right on my topic and I didn't display items because I'd browse the shelf at that number. (one patron, LC)

- It is helpful to search for call numbers in DOC because DOC explains what your call number is about and you can use the BS (browse more specific topics) option to find more specific topics. (two staff, UI; three patrons, LC; one patron, UI)

- If you know the subject of your call number, SOC's call number search is sufficient. If you don't know the subject of your call number, the call number search in DOC is better. (one staff, UI)

- You have to "go fishing" in SOC to find the right call number. (one patron, LC)

- It's better to expand into a topical outline in DOC's call number search than just seeing retrieved items in SOC's call number search. (one staff, LC)

There were a number of staff at PLCFC and one patron who relied solely on call number searches in DOC. The staff had first consulted the PLCFC printed Subject Guide (1978) adjacent the catalog. The Subject Guide was produced by the library and lists subject headings from bibliographic records, class numbers, and the number of items bearing the listed class numbers. For example, a staff member searching for the topic "Planning children's parties" entered that phrase into SOC through alphabetical and direct searches and retrieved zero items. Then the user checked the Subject Guide under this entry:

> Children's parties. J793(6); 793(3); J793.2(2)
> J793.21(2); Jq793; J790; q745.5; 745.54;
> 793.21; SEE ALSO Pinatas

Since six items were classed in 793 according to the Guide, the user first entered 793 into SOC but when he retrieved 811 items, he didn't display any. He then entered 793.2 and retrieved 42 items in SOC which he also failed to display. Then he entered 793.21 and retrieved 14 items; considering this a reasonable number of items, he displayed all of them and judged all but 2 items relevant.

There were times when searchers entered a general (i.e., three-digit) call number that they had not retrieved in other subject searches. Searchers then seemed to wander aimlessly through the catalog and seldom, if ever, retrieved and displayed relevant items. In a DOC search for "Basketball," the user-entered class number 791 generated a List of Topics in which the user-entered class number was listed along with its caption, "Public performances," where library material on topics such as motion pictures, radio, television, and circuses was found. After browsing for a while, the user started the search over again and chose subject search options other than the call number search.

Patrons and staff whose call number searches wound up as aimless wandering through the catalog usually entered short, three-digit class numbers, or class numbers where items on a variety of topics were classed. In a DOC search for "19th century railroad tours of New York State," the class number 917.47 was common to all four items retrieved and displayed in a direct search for this topic. The user entered 917.47 in a class number search, retrieved 1,815 items, and did not display any of these items. The searcher's action of entering this call number was a logical one given the class numbers of the relevant items retrieved in the direct search. Staff and patrons noted that call number searches retrieved many items:

- When you enter a call number, you get too many items. (one staff, UI; three staff, NYSL)
- I got call numbers from items I'd displayed but I entered the numbers and obtained too many items. This isn't always a sound searching strategy. (one staff, NYSL)
- I would like to browse more specific topics in SOC's call number search because it retrieves too many items. (three staff, LC)
- How can a call number search help you? It retrieves too many items. (one staff, LC)
- I'd like to limit the results of call number searches by combining results with Boolean operators. (one staff, LC)

Call number searches in DOC generated a List of Topics around the user-entered class number; however, a List of Topics could only be constructed when users entered valid class numbers enumerated in the 19th edition of the DDC Schedules. When users entered class numbers found on retrieved relevant records but not in the 19th edition of DDC, the system responded with an explanatory message telling them how to successfully enter a class number into DOC:

```
>>>>> YOUR REQUEST...sc:658.054

THE SEARCH WAS NOT SUCCESSFUL BECAUSE OF ONE OF THESE REASONS:
1.  IF YOUR CALL NUMBER IS OUTSIDE THE RANGE 330-333, 336-339, 380-382, 650 OR
    658-659, PLEASE CHOOSE A NUMBER WITHIN THE RANGE.
2.  IF YOUR CALL NUMBER IS WITHIN THE RANGE, THEN IT MUST BE TOO LONG, PLEASE
    SHORTEN IT.
```

Searchers' discouragement with this message led us to conclude that in this instance we should have implemented a shelflist browsing by title capability in DOC. This would have allowed searchers whose entered class numbers matched one contained on an item and did not match a class number in the 19th edition of the DDC Schedules to display items in shelflist (i.e., class number) order. In a direct search in DOC for "Uses of Microcomputers in Business," a staff member identified 658.054 as a class number that he'd enter using the call number search; however, DOC displayed the discouraging message and the searcher would have had to enter the class number 658.05 to retrieve and display items with the desired number. Had DOC instead responded with a list of titles in shelflist order similar to the shelflist display in LCS (see fig. 2), the user would have retrieved items entitled Catching up with the computer revolution, Choosing and using a business microcomputer, Computers in business: how managers are using computers to support their decision-making, and Handbook of computer applications for the small or medium-size business.

In call number searching in both SOC and DOC, users had to first identify a class number of interest using a subject seaching option other than the call number search option. Both patrons and staff culled the class numbers in retrieved, relevant items displayed in alphabetical, direct, or subject outline searches, entered these numbers into the system, and, in many instances, retrieved additional relevant items. Sometimes they culled a class number from the results of an alphabetical or direct search that was highly posted in a call number search and, thus, did not retrieve additional relevant items because there were items on many different and general topics assigned the same class number as the one culled by the searcher. Searchers preferred DOC's call number search to SOC's call number search because the former provided them with a List of Topics from which they could choose a listed topic or manipulate the list by browsing more specific or general topics.

The searcher usually needed some guidance entering class numbers--from the results of searches other than call number searches or from a Subject Guide listing of subject headings and class numbers--otherwise, entering a class number was like a shot in the dark because the searcher did not know the "meaning" of a class number in SOC or DOC until retrieved items or the List of Topics was displayed, respectively. In shot-in-the-dark searches in SOC, searchers repeatedly entered different class numbers and displayed a few items until they obtained satisfactory results or gave up. In shot-in-the-dark searches in DOC, searchers employed the browsing and selecting options until they obtained satisfactory results or gave up.

Call number searches were best when the system response was a List of Topics with system options to browse and select listed topics. When searchers entered a class number from which a List of Topics could not be constructed, i.e., a class number that was not listed in the 19th edition of the DDC Schedules, DOC should have responded with a shelflist browsing display of titles so that the user could at least browse the titles (and other bibliographic information, as needed) of the items shelved in the neighborhood of the user-entered call number. A shelflist-browsing-by-title capability is recommended for online catalogs enhanced with the DDC to support class number searches that fail because the user-entered class number is not enumerated in the Schedules but is assigned to the library's bibliographic records.

8.7 Users' Expressed Needs for Online Catalog Searching

Answers to post-search interview questions shed light on searchers' difficulties using the experimental online catalog and their needs for improvements to the catalog. The results of post-search interviews also provided insight into staff and patrons' needs for searching in online catalogs with or without the DDC. This section features the remarks of online retrieval test participants with regard to their needs of online catalog searching that are not necessarily specific to an online catalog enhanced with the DDC.

8.7.1 Subject Searching Options

SOC featured three different subject searches, i.e., alphabetical, direct, and call number searches; DOC featured four different subject searches, i.e., alphabetical, direct, subject outline, and call number searches. SOC and DOC provided searchers with short online descriptions of these searches when they began their searching in each of the two catalogs. The sample SOC and DOC searches in appendixes M and N, respectively, show these descriptions at the beginning of each online search. We changed the descriptions and option names of these searches many times upon suggestions from OCLC and project participant reviewers (see section 5.6.5 and appendix G) to ensure that the descriptions of subject searches would be understandable to staff and patron searchers in online retrieval tests. After installing the experimental online catalog at UI and reviewing the results of pretests with UI patrons, we "froze" the wording of these descriptions, that is, the wording of these descriptions did not change after the UI pretest, because we felt that it was best for the searcher to select experimental online catalog searches to see for themselves how each search worked. Some online retrieval participants noted that they had to use each subject search option to figure out what it did:

- I wasn't able to distinguish among the searches until I used them. (one patron, NYSL)
- You have to use the different search options to find out what happens, how the computer responds, and how items are retrieved. (five patrons, UI)
- As you use the catalogs, it becomes more evident what each subject search option does. (one staff, LC)

Most searchers called upon two or more different subject search options in the course of their online searches in SOC and DOC. They expressed surprise when the system provided them with different results--in terms of the number of items retrieved--in searches using different subject search options for the same user-entered term.

- I was baffled why I got 3 items in an alphabetical search and 13 items in a direct search for the same topic. (one patron, LC)
- Why did I obtain 13 items in an alphabetical search and 14 items in a direct search for the same topic? (one staff, NYSL)
- I couldn't figure out why the direct search obtained many items and the alphabetical search resulted in none. (one patron, NYSL)
- Why did the alphabetical and direct searches retrieve a different number of items? Are they searching the same fields in the records? (one staff, LC)

More than one searcher called for more detail in the subject search descriptions provided by the experimental online catalog. We felt that the short descriptions of the subject searching options were adequate for attaining the objectives of the online retrieval tests; however, in an actual online catalog--with or without the DDC--we would provide detailed descriptions of each option, particularly each subject searching option, in printed instructions, online help screens, and an interface for first-time or infrequent users of the online catalog. Library staff were particularly keen on printed descriptions or handouts. Here are searchers' requests for detailed descriptions:

- I want the system capabilities explained in greater depth, especially the different subject search options. (two staff, LC; two staff, UI)

- I need a printed guide to find out what each subject search option does and its source of indexing terms, even though the systems were very user-friendly. (three staff, LC; three staff, NYSL)

- A help feature is needed, at least to tell what the subject search options do. (one patron, UI; one staff, NYSL; one staff, UI)

- Provide explanations of what each option means and does. (two patrons, PLCFC; one patron, NYSL; two patrons, LC; one staff, UI; one staff, PLCFC)

- Provide a handout to tell you the differences and similarities among the different subject search options. (one staff, UI)

Searchers wanted the system itself to determine which subject searching option provided the best results for the user-entered term:

- I was unsure which subject search option to select. I need to know which option will produce the best results. (two patrons, PLCFC)

- It isn't clear at first what each search option does or which option is best given one's topic and situation. (one patron, NYSL)

- I didn't know which subject search option would give the best results. Why can't the system tell me which option is best? (one staff, LC)

Two different interfaces for subject searching and known-item searching have been suggested by Matthews and Lawrence (1984, 368) based on their reworking of the survey data collected in the CLR-sponsored Online Catalog Project. Online retrieval test participants' remarks regarding subject searching in the experimental online catalog confirmed Matthews and Lawrence's call for different system interfaces. Online catalogs now support known-item searching in the form of alphabetical author searching, alphabetical title searching, and a combination of author and title searching, and/or keyword author searching, keyword title searching, and a combination of author and title searching. Since patron and staff searchers have been able to differentiate between author and title searching, a different interface for subject searching would not necessarily require them to be able to differentiate right away between direct (or keyword), alphabetical (or subject heading), call number, and subject outline searching. But it would require them to differentiate between these different subject searches in terms of the feedback each subject search provides them with regard to searching terminology and the results (i.e., retrieved items). Only then could users begin to differentiate between different subject searches and choose one over another in view of their topic of interest, personal style of searching, or search objectives. Until our online library catalogs are instilled with sufficient expertise and intelligence to automatically identify which type of subject searching option provides the best results for the user-entered term, we need to equip online catalogs with a subject searching interface that at least provides satisfactory explanations of and instructions for online catalog searching and the catalog's different subject searches in the form of online tutorials, help screens, online prompts and messages, and hardcopy guides.

8.7.2 Finding the Right Terms to Enter into the Online Catalog

In the CLR-sponsored Online Catalog Projects, patrons expressed in focused-group interviews that they had problems finding the right subject heading (Markey 1983b, 137-138). Patrons and staff in online retrieval tests in this study expressed similar problems. They noted that the systems were dependent on subject headings and that they needed help finding a suitable term:

- You have to know the right subject heading to get results in SOC. (one staff, PLCFC)
- When I have trouble finding the right or related subject heading, I need help finding the right subject term to enter. (two staff, UI)
- I need help determining what to do next when I can't find the right subject heading. (two staff, UI)
- It is difficult finding the right subject heading that would lead to a few titles. (three patrons, UI)

Online retrieval tests participants found it difficult to express their topic in terms that would retrieve relevant items in SOC or in DOC:

- I was unsure what term to enter into the catalog for my topic. (one staff, PLCFC; one patron, PLCFC)
- I had difficulty finding relevant items until I used a subject heading I found in a retrieved, relevant item. (one staff, PLCFC)
- I found it difficult to express a concept such as the "founding" of a city. (one staff, NYSL)
- I had difficulty determining how to enter "19th century" as numbers or words. (one staff, NYSL)
- I entered a term a few times and couldn't find any items so I entered a broader term than my topic. (one patron, UI)

Patrons and staff suggested ways in which the experimental online catalog could help them match their terms with indexed terms in the online catalog:

- The catalogs tell you what to do, but not how to interpret what you have found. (one staff, UI)
- The catalog should disregard your punctuation and punctuation in listed terms in alphabetical searches to make a match. (one staff, PLCFC)

- Users should be told to reenter their terms in alphabetical searches by flipping their terms to browse a different part of the alphabet. (one patron, LC)

- Tell users they can enter and browse subject headings so they can consult the LCSH books. (two staff, LC)

In the discussion of alphabetical searches (section 8.5.4), we provided a number of patron and staff comments which expressed a need for lists of related terms such as those in the printed LCSH. Online retrieval test participants also found the subdivisions of main subject headings displayed in SOC's alphabetical search useful for representing a more specific aspect of the main heading.

8.7.3 Limit Capabilities

In a discussion of the subject outline search (section 8.4.7), searchers wanted to limit their search results by another term for one of two reasons: (1) to express another facet of a multifaceted topic or (2) to reduce the number of items retrieved. Patrons and staff also wanted to reduce the results of alphabetical, direct, and call number searches. The UI database contained much foreign language material on mathematics and both patron and staff searchers wanted to limit search results by language. NYSL searchers who performed searches for topics such as "19th century guide-books for touring Niagara Falls" or "19th century summer resorts in New York State" wanted to limit their search results to material covering the 19th century. A limit by date of publication capability could have helped these searchers who wound up displaying and scanning retrieved items to find ones on the 19th century. Post-search interview remarks by searchers showed that they wanted to limit searches by: (1) language, (2) date of publication, (3) another subject word or phrase, (4) juvenile material, (5) chronological period, and (6) geographical area.

8.7.4 Bibliographic Record Displays and Output Control Capabilities

SOC and DOC featured one display of retrieved bibliographic records--full record displays--because we wanted users to base their relevance assessments on one representation of a bibliographic record in online retrieval tests. We obtained many comments in post-search interviews in which patrons and staff at all four libraries underlined the need for short title displays:

- The system should supply brief title and call number information (for retrieved items). (two staff, PLCFC; one staff, NYSL; nine patrons, UI; four staff, LC)

- I'd like brief title information, especially in highly posted subject outline searches, to screen out nonrelevant titles. (eight patrons, LC; eight patrons, NYSL)

- I wanted to see more than one item at a time. (one staff, NYSL)

- List brief title information first, then give me the option to display full records. (one patron, PLCFC)

Patrons and staff wanted to manipulate retrieved items in various ways:

- I want to back up to see an item that I've displayed previously. (one staff, LC; one patron, UI; one patron, NYSL; two staff, PLCFC)
- I want a capability to selectively print out items of interest. (three patrons, UI; three patrons, PLCFC; three staff, PLCFC)
- The system shouldn't display an item it displayed earlier. (one patron, UI)
- I want to skip to later titles in a large set of retrieved items. (one patron, NYSL; two staff, NYSL)
- I'd like to sort retrieved items by the geographical area of a book's contents or in chronological order of a book's contents. (one patron, NYSL)

Only one searcher disliked the order of fields in bibliographic record displays and preferred listing author and title information before subject information. With Matthews and Lawrence's call for different interfaces for known-item and subject searches, we feel that full and intermediate bibliographic record displays in subject searches should list subject information first.

Following the entry of a user-entered term in all subject searches (except for call number searches in SOC and direct searches in SOC and DOC), the searcher's first action was usually to select from the List of Aspects or List of Topics using the SL (select line[s] to display items) option. Entering the SL option to select a listed aspect or topic seemed to give searchers many problems. For example, they would enter the line letter before the SL option instead of the SL option followed by the line letter. They would enter the SL option, then type in the line letter and the entire aspect or topic. They would enter the SL option and the word "ALL" (when they really wanted one or two lines) and wound up with a retrieved set of many nonrelevant items.

Such user actions either produced undesirable results or failed to further the progress of the search but did not put the searcher into a situation from which he could not recover except by starting over. Yet, these user actions are evidence that online catalogs have to be forgiving and well-equipped with point-of-need error messages and explanatory help screens in comparable situations to aid users in the course of their searches. That is, we can expect online catalog searchers to make entry errors in the next logical step in the online catalog search when the search results of the user-entered term are first presented. For, this is the first opportunity that the user has to do something besides enter his term and has a choice of next steps, e.g., browsing alphabetical subject headings, dislaying items, or starting over. Thus, we can expect a large share of errors at this point. Online catalogs must provide online aids to help the online searcher at such points in the ongoing search.

In online retrieval tests, we found that patrons and staff did not display all items in a retrieved set of items. On the average, patrons displayed 11.2 items in SOC searches per retrieved set of items and 10.3 items in DOC searches per retrieved set of items. Staff displayed 8.9 items in SOC searches per retrieved set of items and 8.6 items in DOC searches per set of retrieved items. Table 66 shows the number of items retrieved in SOC and DOC searches, the number of items displayed in these searches, and the average number of items displayed per search. The number of items retrieved in DOC searches exceeded the number of items retrieved in SOC searches except by UI staff. DOC's subject outline search was primarily responsible for directing patrons and staff to highly posted class areas for the reasons described in section 8.4. For example, there were 11 subject outline searches which directed NYSL patrons to class number 974.7 where there were 4,939 items. If the subject outline search were enhanced with the suggested improvements, these 11 searches would direct users to more specific class numbers than 974.7 with fewer postings. Subtracting the number of items retrieved in these 11 searches (11 x 4,939) from the total of 62,018 items retrieved by NYSL patrons in DOC searches results in 6,689 items retrieved by NYSL patrons, which is much closer to the 8,571 items retrieved by NYSL patrons in SOC searches.

Table 67 shows that searchers were less likely to display retrieved items when the number of items in a set exceeded 200. When the number of items in a set ranged from 1 to 5 items, SOC and DOC searchers displayed one or more items in this set approximately 94% of the time. When the number of items in a set exceeded 200 items, searchers displayed one or more items in this set approximately 52% of the time. The experimental online catalog's limited capability of displaying items, i.e., a display of one full bibliographic record at a time, was responsible for the small number of items displayed per search. If the experimental online catalog had offered short title displays and full record displays, we feel that searchers would have displayed many more short titles followed by full record displays because the short title lists would have enabled them to quickly scan titles to identify ones that were relevant to their topics of interest for which they would want to obtain a full record display. Short title displays would also have helped searchers wade through large sets of items that were customary in subject outline searches in DOC.

Table 66. Items Retrieved and Displayed in Patron and Staff Searches

	LC SOC	LC DOC	NYSL SOC	NYSL DOC	PLCFC SOC	PLCFC DOC	UI SOC	UI DOC	Total (Four Libraries) SOC	Total (Four Libraries) DOC
Total number of items retrieved by patrons (in 40 searches per library)	9,346	38,875	8,571	68,848	7,962	62,018	11,478	16,933	37,357	186,674
Total number of items displayed by patrons (in 40 searches per library)	512	495	480	378	402	379	402	400	1,796	1,652
Average number of items displayed per patron search	12.8	12.4	12.0	9.5	10.1	9.5	10.1	10.0	11.2	10.3
Total number of items retrieved by staff (in 45 searches per library)	22,419	32,427	5,324	51,857	13,262	26,378	11,353	10,103	52,358	120,765
Total number of items displayed by staff (in 45 searches per library)	318	321	394	335	455	429	430	455	1597	1540
Average number of items displayed per staff search	7.1	7.1	8.8	7.4	10.1	9.5	9.6	10.1	8.9	8.6

Table 67. Percentages of Items Displayed by Ranges of Items Retrieved

	SOC		DOC	
	Number of times n-m items retrieved	Percentages of times 1 or more items displayed	Number of times n-m items retrieved	Percentages of times 1 or more items displayed
1-5 items:				
Patrons	277	95%	102	94%
Staff	181	94%	82	92%
6-10 items:				
Patrons	58	86%	39	90%
Staff	62	94%	40	83%
11-20 items:				
Patrons	56	89%	43	86%
Staff	92	86%	87	90%
21-50 items:				
Patrons	47	89%	72	86%
Staff	54	82%	75	77%
51-100 items:				
Patrons	25	80%	48	83%
Staff	21	81%	28	64%
101-200 items:				
Patrons	22	73%	47	75%
Staff	14	57%	43	63%
over 200 items:				
Patrons	51	53%	126	59%
Staff	42	45%	104	45%

In table 67, the number of times that SOC searches retrieved 1-5 items was at least double the number of times that DOC searches retrieved 1-5 items. Likewise, the number of times that DOC searches retrieved over 200 items was at least double the number of times that SOC searches retrieved over 200 items. These statistics demonstrate that the retrieved sets in DOC searches were larger than those in SOC searches. Table 68 lists the average number of items retrieved per posted subject heading (in SOC), Relative Index entry (in DOC), and Schedule caption (in DOC). Except for LC Schedule captions, the average number of retrieved items per Relative Index entry and Schedule caption are dramatically greater than the average number of items retrieved per Schedule heading. The large number of retrieved items per Schedule caption in the NYSL and PLCFC databases may be attributed to the cumulative postings procedure in both DOC databases and the failure of library staff to use the low levels of the DDC Schedules in the PLCFC database. In view of such high posted Relative Index entries and Schedule captions, the need for short title displays and limit capabilities is very important to an online catalog with the DDC to enable searchers to quickly scan many retrieved items and to limit sets of retrieved items by a criterion such as another term, language, or date of publication.

Table 68. Average Number of Items Retrieved per Heading, Entry, and Caption

	LC	NYSL	PLCFC	UI
Average number of items retrieved per subject heading	1.56	1.98	3.33	4.96
Average number of items retrieved per Relative Index entry	19.97	57.79	33.02	45.76
Average number of items retrieved per posted Schedule caption	4.4	76.75	36.21	72.31

8.7.5 New System Capabilities

Online retrieval test participants made a number of suggestions for system capabilities that have been implemented in most online catalogs, e.g., truncation, Boolean searching, circulation function, known-item searching. Their suggestions that have not been implemented in any online catalog or a few catalogs are the following:

- Once you retrieve a relevant item, it would be helpful if the system could find more items like the one retrieved. (one staff, UI)
- You need scratch paper to write down call numbers, titles, etc. (one staff, NYSL)
- I want the ability to find a subject heading when I enter its subdivision (so provide me with an alphabetical keyword-in-context list of subject headings). (one staff, NYSL)
- I want SOC and DOC to index names of people to answer the question (for genealogical research) "Who was where and when?" (five patrons, NYSL)
- I'd like the ability to search a book's index. (one patron, NYSL)

8.8 Search Satisfaction and System Preference

In post-search interviews, library patrons and staff were asked which system was most satisfactory for the search and the reason why it was satisfactory in the system selected. They were also asked their system preference and reason for such a preference. In a discussion of the time spent performing online catalog searches, we showed that time spent searching did not affect the search satisfaction or system preference of online retrieval test participants (see section 7.3 and tables 23 and 24). The discussion of precision in online catalog searches showed that precision had an effect on staff search satisfaction (see section 7.5.3 and table 46). The variable that had the greatest impact on patron and staff search satisfaction and system preference was recall (see sections 7.4.2 and 7.4.3). Patrons and staff expressed satisfaction with the search in the system which yielded higher recall (see tables 31 and 39); patron system preference was related to the system which yielded higher recall (see table 33) and staff system preference was related to the system yielding higher precision (see table 40). A discussion of the reasons for searchers' search satisfaction and system preference (besides recall and precision, which are covered elsewhere) is featured in this section.

Table 69 contains the numbers and percentages of patrons who expressed satisfaction with the search in SOC and DOC based on the purpose of their search. Most patrons in the Sample Search Experiment were performing a search of personal interest so the numbers of patrons in the three other categories are small. Patrons performing searches for class-related purposes or personal interest expressed satisfaction with the search in SOC; however, patrons performing searches for research purposes expressed satisfaction with DOC or did not express satisfaction with the search in either system. Table 70 shows the numbers and percentages of patrons' system preference. Patrons preferred SOC when performing searches for class-related purposes or personal interest; patrons preferred DOC when performing searches for research-related purposes.

Table 69. Satisfaction and Purpose of Patron's Search

In relation to what you were looking for, was the search more satisfactory in:	The purpose of your online catalog search is for: %Class or course-related purposes	%Personal interest	%Advanced research	%Job purposes
SOC	54	53	20	44
DOC	29	30	40	17
No difference	17	17	40	39
Number of cases =	24	103	15	18

Table 71 contains the numbers and percentages of patrons and staff who expressed satisfaction with the search in SOC or DOC or expressed no difference between systems with respect to their satisfaction with the search. At LC, NYSL, and PLCFC, the largest percentage of patrons and staff expressed satisfaction with the search in SOC. At UI, large percentages of patrons and staff expressed

Table 70. System Preference and Purpose of Patron's Search

The next time you need to conduct a computer catalog search, will you choose:	The purpose of your online catalog search is for:			
	%Class or course-related purposes	%Personal interest	%Advanced research	%Job purposes
SOC	46	50	40	39
DOC	33	28	47	33
No difference	21	22	13	28
Number of cases:	24	103	15	18

Table 71. Search Satisfaction of Patrons and Staff

In relation to what you were looking for, was the search more satisfactory in:	LC		NYSL		PLCFC		UI		Total (Four Libraries)	
	%Patrons	%Staff	%Patrons	%Staff	%Patrons	%Staff	%Patrons	%Staff	%Patrons	%Staff
SOC	40	38	40	46	75	38	40	31	49	38
DOC	33	33	33	25	15	27	45	42	31	32
No difference	27	29	27	29	10	35	15	27	20	30
Number of cases =	40	45	40	45	40	45	40	45	160	180

satisfaction with the search in DOC. The most frequent reasons cited by online retrieval test participants for expressing satisfaction with the search in SOC (except for reasons relating to recall) are the following:

1. SOC was direct, easy to use and understand to find relevant items on a topic. (six patrons, LC; one patron, NYSL; four staff, NYSL; two patrons, NYSL; one staff, NYSL; one patron, UI)

2. SOC provided specificity and a browsing capability in its alphabetical list of subject headings. (two patrons, LC; two staff, LC; three staff, NYSL; ten patrons, NYSL; two staff, NYSL; seven patrons, UI)

3. Searchers were more familiar with an online catalog based on Library of Congress subject headings than a different scheme. (one patron, LC; three staff, LC; three patrons, NYSL; one staff, NYSL)

4. Items retrieved in SOC were specific to the user's topic. (two staff, LC; one patron, NYSL; four patrons, PLCFC; two staff, PLCFC; one patron, UI; one staff, UI)

5. It probably depends upon the topic searched, but SOC worked well for the search today. (one patron, LC; two staff, LC)

6. SOC retrieved relevant items faster than DOC. (two staff, LC; four patrons, NYSL; one staff, NYSL; four patrons, NYSL; two patrons, UI; one staff, UI)

The most frequent reasons cited by online retrieval test participants for expressing satisfaction with the search in DOC (except for reasons relating to recall) are the following:

1. The subject outline search provided users with topics and options for directing them to relevant items. (five patrons, LC; two staff, LC; one staff, NYSL; three staff, PLCFC; three patrons, UI; one staff, UI)

2. DOC provided a more thorough search than SOC. (three staff, LC; one staff, NYSL; one patron, UI)

3. DOC provided a list of related topics. (one patron, LC; one staff, LC)

4. DOC had more options than SOC. (one staff, LC; four patrons, NYSL; four staff, PLCFC; one patron, UI; nine staff, UI)

The most frequent reasons cited by online retrieval test participants for expressing no difference between the two systems with respect to their satisfaction with the search were chiefly concerned with the amount of relevant items retrieved in both systems: (1) SOC and DOC retrieved the same relevant items or the same amount of relevant items; (2) SOC and DOC did not retrieve any relevant items for the topic searched; (3) it depends on the topic searched; or (4) the user wanted more online experience upon which to base his preference.

Table 72 shows the numbers and percentages of patrons and staff and their preferences for SOC or DOC. Overall and at individual libraries, patrons preferred SOC and staff preferred DOC. The same percentage of patrons and staff at LC preferred SOC and DOC; at LC, the largest percentage of patrons performing searches for research purposes was obtained (see table 15).

Table 72. System Preference of Patrons and Staff

The next time you need to conduct a computer catalog search, will you choose:	LC		NYSL		PLCFC		UI		Total (Four Libraries)	
	%Patrons	%Staff	%Patrons	%Staff	%Patrons	%Staff	%Patrons	%Staff	%Patrons	%Staff
SOC	40	40	67	33	40	20	40	20	47	28
DOC	40	33	20	47	28	47	38	53	31	45
No difference	20	27	13	20	32	33	22	27	22	27
Number of cases =	40	15	40	15	40	15	40	15	160	60

The most frequent reasons for searchers' preferring SOC were the same as their reasons for satisfaction with the search. Examples of patron and staff comments are the following:

1. SOC is direct, easy to use and understand to find relevant items on a topic.

   - SOC has fewer options so you're less likely to get confused. (one patron, NYSL)

   - I felt comfortable using SOC because of its simplicity and few search options. (one staff, NYSL)

   - I didn't have to expend much effort to find relevant items. (one staff, NYSL)

   - SOC's organization is easy to follow and understand. (one patron, PLCFC)

2. SOC provided specificity and a browsing capability in its alphabetical list of subject headings.

   - I like the specificity of and ability to see the first word of your entered topic in SOC's alphabetical list. (one patron, NYSL)

   - It was easy to narrow my topic in SOC by browsing the list of subject headings. (one patron, PLCFC)

3. The searcher was more familiar with an online catalog based on subject headings.

4. Items retrieved in SOC are specific to the user's topic.

   - The items were more specific to my topic than scanning a lot of DOC output. (one patron, LC)

5. It probably depends upon the topic searched, but SOC worked well for my topic today.

6. SOC retrieved relevant items faster than DOC.

   - SOC has fewer options than DOC, is quicker to search, and gets the same results as DOC.

   - It's faster to do the search in SOC (than in DOC). I can decide at the catalog what books I want, then go to the shelf. (one patron, UI)

The most frequent reasons for searchers' preferring DOC were the same as their reasons for satisfaction with the SOC with the addition of another reason. Examples of patron and staff comments are the following:

1. The subject outline search provided users with topics and options for directing them to relevant items.

   - I liked the subject outline search because it gives you a breakdown of topics within a general topic. It helps clarify what you're looking for. (one staff, LC)

   - The subject outline search provided me with relevant items and the capability to narrow into specific areas of my topic. (one patron, UI)

   - DOC provides capabilities to browse more specific and general topics and you don't have to rely on LC subject headings to find relevant items. (one staff, UI)

2. DOC provides a more thorough search than SOC.

   - DOC provided more items on the topic searched. Its search is more comprehensive. (four patrons, LC)

   - DOC provided a thorough search that was easy to follow and keep on track. (one staff, LC)

   - SOC needs DOC's extra subject search options to make sure that the search has been done thoroughly. (one staff, UI)

   - DOC gives you more paths to your subject. (one staff, UI)

3. DOC provides a list of related topics.

   - DOC provides a list of related and organized topics and gives you a spectrum of possibilities that is a more stimulating response than SOC. (five patrons, LC)

   - You can still enter LC subject headings but you can also enter terms and be led to broad and specific topics. (one staff, LC)

4. DOC has more options than SOC.

   - DOC has more options than SOC, is a larger and more powerful catalog than SOC. (one patron, LC)

- DOC has more search options than SOC. SOC and DOC search options should be combined into one system so you can search LC and Dewey subjects. (one staff, NYSL)

5. DOC shows how a topic is treated from various broad perspectives.

   - DOC gives you a broad view of your subject from various perspectives. (two patrons, NYSL)

   - I usually don't look at specifics (in the catalog). I like to go to the general areas on the bookshelves and look through the books--tangible things--for information. (one patron, UI)

The most frequent reasons cited by online retrieval test participants for not preferring one system over the other were virtually the same as their reasons for expressing no difference between the two systems with respect to their satisfaction with the search: (1) SOC and DOC retrieved the same relevant items or the same amount of relevant items; (2) SOC and DOC did not retrieve any relevant items for the topic searched; (3) it depends upon the topic searched; (4) the user wanted more online experience upon which to base his preference; or (5) the user observed no differences between the two systems. Here are some other reasons independent of the five listed.

- I'd like a combination of both catalogs because the list of topics in each cover different areas. (one patron, UI)

- SOC finds relevant items quickly but DOC is more powerful. (one staff, NYSL)

- I'd use both SOC and DOC for serious research to make sure I'd been comprehensive. (one patron, NYSL)

- You have to use the capabilities of both SOC and DOC to get a complete answer as to books on your topic. (one patron, PLCFC)

8.9 Summary

The success and failure of the experimental online catalog's subject searching capabilities to direct searchers to relevant items on their topics of interest were featured in this chapter. The three subject searching capabilities of SOC and the four of DOC were not comparable in terms of their performance for retrieving relevant items for a user's topic of interest (see tables 48 and 49 and section 8.1). The alphabetical searches of SOC and DOC and subject outline search of DOC did not direct searchers to relevant items without their use of supporting options to browse and select from online displays of subject terminology. The results of DOC's alphabetical and subject outline searches were not especially fruitful in relevant items for a user's topic. Failure analyses of these two subject searching capabilities identified the reasons why these capabilities sometimes failed to retrieve relevant items and included suggestions for improving these capabilities (see sections 8.4 and 8.5).

In online retrieval tests, a total of 342 searches were conducted by patrons and staff in SOC and 338 searches were conducted by patrons and staff in DOC. Successful searches in SOC, i.e., searches resulting in relevant items for a patron's expressed topic or a staff member's assigned topic, amounted to 90%. Five percent of SOC searches failed to retrieve relevant items in SOC, but a DOC search for the same topic was successful. Five percent of SOC searches failed to retrieve relevant items, and a DOC search for the same topic also failed to retrieve relevant items. The percentages of successful and unsuccessful searches in DOC were comparable to those in SOC. Successful searches in DOC amounted to 86%. Nine percent of DOC searches failed to retrieve relevant items in DOC, but a SOC search for the same topic was successful. Five percent of DOC searches failed to retrieve relevant items, and a SOC search for the same topic also failed to retrieve items (see table 53 and section 8.2). Individual reasons for the failure of SOC and DOC searches are listed in tables 50-52. Failure analyses of direct searches (section 8.3), subject outline searches (section 8.4), alphabetical searches (section 8.5), and call number searches (section 8.6) describe these reasons and their implications in greater depth.

The percentage of times that the direct search led users to relevant items was greater in DOC than in SOC, and the percentage of times that users' direct searches resulted in no retrievals was greater in SOC than in DOC (table 54). Online searches in which direct searches were performed were singled out. The estimated recall ratios of DOC direct searches exceeded the estimated recall ratios of SOC direct searches (table 55). These results about relevant items, no retrievals, and recall of direct searches in DOC are evidence that the enhancement of bibliographic records with the DDC improved subject access in DOC's direct search.

The direct search was particularly effective in retrieving relevant items on a topic when the user-entered term matched words in a relevant subject heading (section 8.3.4). When the user-entered term was not composed of words from relevant subject headings, it sometimes resulted in the retrieval of relevant items, nonrelevant items, or no retrievals. Unlike the alphabetical and subject outline searches, the direct search provides no feedback to the searcher in terms of the catalog's searching vocabulary. When the user-entered term is not composed of words from a subject heading but retrieves items, the system could provide feedback to inform the user of subject headings common to the majority of retrieved items and to allow the user to select a common subject heading(s) or other criteria in retrieved, relevant items to retrieve additional items. A few users in online retrieval tests enlisted this strategy by noting relevant subject headings in retrieved, relevant items in direct searches and entered these headings into the catalog using a direct or other subject search.

In SOC or DOC, there was no feedback capability identifying common subject headings in retrieved items (section 8.3.5). After retrieving nonrelevant items or no retrievals in direct searches, users often continued their search by entering a term that was broader than their expressed topic and resulted in many retrievals. The enhancement of bibliographic records with the DDC sometimes resulted in the retrieval of too many retrievals and false drops in direct searches (section 8.3.6). Most users were able to circumvent such results by entering their term into SOC or DOC using a different subject search option. Another reason for the failure of the direct search was its tendency to misguide users by directing them to a classification area where a number of items on a topic were located based on the retrieval and display of a few items in a set although there was a better area where items on a topic were located.

Patrons and staff liked the ability of the direct search to refer them immediately to retrieved items without having to use other system options and capabilities. Not all searchers' remarks about direct searches were favorable. Their unfavorable remarks addressed the inability of the direct search to provide feedback about the catalog's searching terminology and the absence of a system capability to alter the results of a direct search (section 8.3.7).

Successful subject outline searches directed users to the specific classification area(s) where there were items matching the user-entered term and relevant to the user's topic of interest (section 8.4.3). In these successful searches, the user-entered term matched a Schedule caption, Relative Index entry, or first-listed subject heading in a bibliographic record. DOC then directed the user to the specific Schedule area where there were items on his topic or the user employed the supporting options of the subject outline search, particularly the browse perspectives (BP) option, browse specific topics (BS) option, and select lines to display items (SL) option.

In unsuccessful subject outline searches, the user-entered term matched a Schedule caption, Relative Index entry, and/or first-listed subject heading in a bibliographic record, but the search failed for the reasons listed below:

1. The listed topic did not necessarily describe the user's topic of interest, so the user didn't display any or a sufficient number of items to find ones on his topic of interest (sections 8.4.4 and 8.4.7).

2. The listed perspective did not necessarily describe the user-entered topic or point of view of the user with regard to his topic of interest so the user started over (section 8.4.4).

3. When a subject heading matching the user-entered term was assigned to items by the subject cataloger, it was assigned to an item with a short (three- or four-digit) class number and a number of items with specific numbers. DOC's grouping procedure in the subject outline search directed the user to the shortest class number, which usually was highly posted and broader than the user's topic of interest (section 8.4.5).

4. The user-entered term matched words in a relevant subject heading, but this subject heading was not used very often in the database and, when it was used, items with this heading were classed in a number with many other items on different topics. Thus, the user-entered term directed the user to a class number that was highly posted and broader than the user's topic of interest (section 8.4.5).

5. The library classifier assigned items on a specific topic to a broad topic and class number that could have been classed into a specific number and topic. Thus, the user retrieved items specifically on this topic and many other items (section 8.4.5).

6. The user-entered term matched words in a relevant subject heading and/or words from a relevant DDC class number area, and, at the same time, matched words in another relevant subject heading and/or words from a relevant DDC class number area with the same base class number as the other matched class number. DOC's procedure for grouping retrieved DDC class numbers and choosing the shortest number in the group was responsible for directing the user to a short number which was broader than the user's topic of interest and highly posted (section 8.4.6).

7. The user-entered term matched words in a relevant subject heading and/or words from a relevant DDC class number area, and, at the same time, matched words in a nonrelevant subject heading and/or words in a nonrelevant DDC Schedule caption, note, or Relative Index entry with the same base class number as the other matched class number. DOC's procedure for grouping retrieved DDC class numbers and choosing the shortest number in a group was responsible for directing the user to a short number which was broad and highly posted (section 8.4.6).

8. The user-entered term matched words in a relevant subject heading and directed the user to an outline that expressed one facet of the user's multifaceted topic of interest (section 8.4.7).

9. The user-entered term matched words in a relevant subject heading and directed the user to an outline whose topics were worded in an ambiguous or confusing way which prompted the user to start the search over again or fail to display items. Most displayed items were not relevant to the user's topic of interest (section 8.4.7).

10. The user-entered term matched words in a relevant subject heading and directed the user to an outline whose topics were more general than the user's topic of interest. Browsing more specific topics did not yield topics specific to the user-entered topic because the user had reached the lowest level of the DDC (section 8.4.7).

Suggested improvements to the subject outline search to provide better searching performance in such searches are the following:

- Changing the grouping procedure so that DOC directs users to the class number and caption with the highest number of postings during the grouping procedure. (Improves searches with problems 3 and 6; improves some searches with problem 7 and adversely affects some searches with problem 7)

- Providing a limit by keyword, date, language, or other criteria as an option when the results of a subject outline search are displayed. (Improves searches with problems 3, 5, 6, 8, 9, and 10)

- Enhancing the display of retrieved items so that the first items displayed in subject outline searches are those that would be retrieved in a direct search for the user-entered term and bear the class number of the outline. (Somewhat improves searches with problems 1, 4, 8, and 9)

Suggested improvements to the DDC to provide better searching performance in online catalog searches are the following:

- Enriching the wording of DDC Schedule captions, especially captions accompanying three-digit DDC numbers, so that their wording describes the subject matter of items assigned the particular class number. Providing more subject-rich notes for Schedule captions. (Improves searches with problems 1, 2, and 9)

- Increasing the specificity of the DDC by adding more specific captions and levels of the hierarchy under highly posted DDC class numbers and captions. (Improves searches with problem 10)

The subject outline search provided online catalog users with a new approach to subject searching. Because this approach to subject searching had never before been implemented in an online catalog, we provided a lengthy failure analysis of this system capability in section 8.4, which stressed the capability's drawbacks and made suggestions for improvement. Regardless of the limitations of the implementation of the subject outline search in the experimental online catalog, patron and staff remarks in post-search interviews noted its benefits:

1. Stimulating users with regard to searching terminology

2. Placing a topic in context

3. Showing where items are located on the shelf

4. Providing a logical organization of topics

5. Providing a capability to browse specific topics

6. Showing users the disciplines which treat their topics of interest

7. Referring searchers to shelf location(s) based on user-entered terms

In alphabetical searches, only 28% to 29% of patron- and staff-entered terms were letter-for-letter matches of subject headings and 1% to 2% of patron- and staff-entered terms were letter-for-letter matches of Relative Index entries (tables 62 and 63). Users' difficulty matching subject headings and Relative Index entries were attributed to their failure to include correct punctuation, abbreviations, and hyphenation in their entered terms and to consult the printed LCSH before or during the online search. Users relied on the supporting options of SOC and DOC for browsing and selecting alphabetically arranged subject headings and Relative Index entries and/or browsing logical Lists of Topics linked to the latter. Because of these lists and supporting options, 53% of patron-entered terms in SOC and 57% of staff-entered terms in SOC and 40% of both patron- and staff-entered terms in DOC were close matches of a listed heading or entry with one or more retrievals (section 8.5.2).

Overall, SOC's alphabetical search directed users to relevant items in a greater percentage of searches than DOC's alphabetical search. Patrons and staff noted the specificity of lists of subject headings in SOC in which main headings and subdivisions often exceeded the initial screen (section 8.5.3). In contrast, lists of Relative Index entries rarely contained one or two headings which matched the initial word of the user-entered term and searchers remarked on the generality of Relative Index entries. SOC searchers frequently called on the browsing forward and backward options to display additional subject headings and subdivisions. The alphabetical lists of subject headings not only helped users match their entered terms with indexed subject headings, but the lists helped them to find headings when they misspelled their entered term, to focus on a specific aspect of a broad topic, or to survey the scope and contents of the database. Subdivisions of main headings were particularly helpful for narrowing users' original expressed topics.

Some searchers thought that the lists of subject headings in alphabetical searches were lists of related terms to the user-entered term (section 8.5.4). These searchers and others (who recognized that the lists of subject headings were an alphabetical arrangement) expressed a need for related terms and cross-references in the catalog. Examples of unsuccessful alphabetical searches that would have benefited from the inclusion of the printed LCSH in SOC were provided in this discussion; however, there were a number of alphabetical searches in which LCSH could not have helped the user because "see also" and "see also from" references were broader than the user's topic of interest, suggested subdivisions contained no such references, and/or geographical subdivisions were not listed among the suggested subdivisions (but were designated by the Indirect reference adjacent the main heading--a designation familiar and understandable to librarians and not to patrons).

There were successful alphabetical searches in DOC when there was a Relative Index entry describing the user-entered term or one facet of the user-entered term (section 8.5.5). The main benefit of DOC's alphabetical search was its ability to direct the user to one shelf area where there were items on the user's topic of interest. This was especially helpful when items assigned a subject heading describing the same topic were classed in a number of different areas and the user found a suitable Relative Index entry which directed him to one class number area of interest. DOC's alphabetical search also had the capability to direct users from the alphabetical lists of Relative Index entries to the logical lists of DDC Schedule captions, where users were able to browse listed topics or topics more specific than those listed and found relevant items.

Relative Index entries perform a good job directing searchers to the classification area where there are items on their topic of interest. Subject headings and subdivisions from a library's bibliographic records provide greater specificity than Relative Index entries and describe subjects, such as personal names, combinations of topical and geographic headings, and two or more topics in a single heading that are not represented by a Relative Index entry. At times, the printed Library of Congress Subject Headings provides searchers with alternative ways of expressing their topic of interest through "see also" and/or "see also from" references. The strengths of each of these sources of subject terminology--Relative Index, subject headings from bibliographic records, and LCSH--should be integrated into a single alphabetical searching capability with supporting options for term browsing and selecting capabilities (see section 9.5.2.2).

Call number searching in both SOC and DOC required users to first identify a class number of interest using a subject searching option other than the call number search option (section 8.6). Both patrons and staff culled the class numbers in retrieved, relevant items displayed in alphabetical, direct, or subject outline searches, entered these numbers into the system, and, in many instances, retrieved additional relevant items. Sometimes they culled a class number from the results of an alphabetical or direct search that was highly posted in a call number search and, thus, did not retrieve additional relevant items because there were items on many different and general topics assigned the same class number as the one culled by the searcher. Searchers preferred DOC's call number search to SOC's call number search because the former provided them with a List of Topics from which they could choose a listed topic or manipulate the list by browsing more specific or general topics.

A searcher usually needed some guidance entering class numbers--from the results of searches other than call number searches or from a Subject Guide listing of subject headings and class numbers; otherwise, entering a class number was like a shot in the dark because the searcher did not know the "meaning" of a class number in SOC or DOC until retrieved items or the List of Topics was displayed, respectively. In shot-in-the-dark searches in SOC, searchers repeatedly entered different class numbers and displayed a few items until they obtained satisfactory results or gave up. In shot-in-the-dark searches in DOC, searchers employed the browsing and selecting options until they obtained satisfactory results or gave up.

Call number searches were best when the system response was a List of Topics with system options to browse and select listed topics. When searchers entered a class number from which a List of Topics could not be constructed, i.e., a class number that was not listed in the 19th edition of the DDC Schedules, DOC should have responded with a shelflist browsing display of titles so that the user could have at least browsed the titles (and other bibliographic information, as needed) of the items shelved in the neighborhood of the user-entered call number. DOC needed a shelflist browsing capability to support class number searches that failed because the user-entered call number was not in the DDC Schedules but was assigned to the library's bibliographic records. Since one of the main sources of class numbers are bibliographic records retrieved in an online catalog search, online catalogs enhanced with the DDC have to support searchers' entry of a class number with a List of Topics (if the entered class number is enumerated in the Schedules) or with a shelflist browsing capability (if the entered class number is not in the Schedules but is in a bibliographic record).

Searchers of the experimental online catalog noticed the availability of more than one subject searching option. Although the catalogs provided a one- to two-line summary of each subject searching capability, patrons and staff noted that they had to use each capability to distinguish among them. Searchers also wanted the system to automatically identify the subject searching option that would give them the best results for their user-entered term (section 8.7.1). Like searchers in previous studies of online catalogs, searchers in this study had difficulty finding the right terms to enter into the catalog and wanted online aids for helping them find searching terminology (section 8.7.2).

Patrons and staff wanted to limit the results of their subject searches by various criteria, e.g., date of publication, another term, chronological period (section 8.7.3). Online retrieval test participants remarked that a limit capability was especially needed in subject outline searches (section 8.4.7).

For the purpose of the online retrieval tests, SOC and DOC only featured displays of full bibliographic records. Searchers called for brief title displays and display capabilities, such as backing up and skipping forward in the display of records, sorting output, and suppression of items previously displayed (section 8.7.4). Only one searcher of 220 different searchers disliked the display of subject-rich fields first in bibliographic records.

Patrons and staff did not display all items retrieved in online searches. Searchers were less likely to display retrieved items when the number of a set of items exceeded 200 (table 67). The number of times that DOC searches retrieved over 200 items was at least double the number of times that SOC searches retrieved over 200 items. Thus, users' failure to display items probably had an adverse effect on DOC searches because of highly posted sets in DOC searches. DOC users would have benefited from brief title displays to quickly scan titles and identify ones relevant to their topics of interest for which they could have obtained full record displays.

An earlier discussion of search satisfaction and system preference (sections 7.4.2 and 7.4.3) demonstrated a relationship between search satisfaction and estimated recall and system preference and recall. Overall, patrons expressed satisfaction with the SOC search and staff were divided between SOC and DOC with regard to their search satisfaction (table 71, section 8.8). The most frequent reasons for searchers' satisfaction with the SOC search were (1) SOC was direct, and easy to use and understand to find relevant items; (2) SOC provided specificity and a browsing capability in its alphabetical list of subject headings; (3) the searcher was more familiar with an online catalog based on Library of Congress subject headings; (4) items retrieved in SOC were specific to the user's topic; (5) it probably depends upon the topic searched, but SOC worked well for the search today; and (6) SOC retrieved relevant items faster than DOC.

Patrons performing searches for research purposes expressed satisfaction with the DOC search and preferred DOC (tables 69 and 70). Other frequent reasons for searchers' satisfaction with the DOC search were (1) the subject outline search provided users with topics and options for directing them to relevant items; (2) DOC provided a more thorough search than SOC; (3) DOC provided lists of related topics; and (4) DOC had more options than SOC.

Overall, patrons preferred SOC and staff preferred DOC (table 72). The most frequent reasons for searchers' preference for SOC were the same as those cited for their search satisfaction. The most frequent reasons for searchers' preference for DOC were the same as those cited for their search satisfaction with the addition that DOC showed how a topic is treated from various perspectives.

9. Integrating the DDC into Online Catalogs and Online Cataloging Systems

9.1 Introduction

For the DDC Online Project, the Dewey Decimal Classification provided subject-rich information for the enhancement of bibliographic records and an online catalog's subject searching capabilities. The analysis of the online retrieval tests in chapters 7 and 8 focused on the evaluation of the latter enhancement. The evaluation of the former enhancement was partially treated in discussions of the performance of each subject searching capability with regard to retrieving items and retrieving relevant items in response to the user-entered term (sections 8.1, 8.3.2, 8.4.2, 8.5.2, and 8.6). For example, we saw how direct searches in DOC retrieved zero items less frequently than direct searches in SOC and concluded that the enhancement of DOC bibliographic records with the DDC improved subject access in DOC.

Sections 9.2 and 9.3 focus on the evaluation of the DDC enhancement of bibliographic records in both quantitative and qualitative analyses. Section 9.2 highlights the links to class numbers from Schedule captions and notes and Relative Index entries and from first-listed subject headings. Section 9.3 explores the contribution of the DDC enhancement to bibliographic records. The numbers and percentages of unique words contributed successively by the seven subject-rich fields in DOC bibliographic records (i.e., subject heading, title, notes, series, sponsor, Relative Index, and Schedule fields) are featured. Surprised by the large proportion of unique terms contributed by the DDC, we separated these unique terms into categories for satisfactory and unsatisfactory indicators of a book's subject contents. Examples of the unsatisfactory indicators of contents show that some Schedule captions require changes to become understandable to online catalog users.

The experimental online catalog was installed in the Decimal Classification Division of the Library of Congress for one month. Library staff of the Division who performed classification and editorial work were interviewed about their use of the experimental online catalog. Their interview comments, summarized in section 9.4, described their use of the catalog and suggestions for improving it to facilitate their library work. In section 9.5, we draw on our knowledge of and experience with the experimental online catalog and the results of the data analyses to recommend and describe uses of a library classification in online catalogs and online cataloging systems and the capabilities required to best serve users of these systems. We tempered these ambitious recommendations with a description of the necessary capabilities for an online cataloging system and online catalog to handle the DDC for use by library staff performing classification tasks and library patrons performing subject searches in the concluding section 9.6 of this report.

9.2 Links to Class Numbers in the DDC and Bibliographic Records

In DOC, the subject outline search enabled searchers to enter a term and be directed by the system to the classification area(s) where there were items containing the user-entered term. The index to the subject outline search was composed of words from Relative Index entries, Schedule captions and subject-rich Schedule notes, and the first-listed subject heading in bibliographic records for every class number in the 19th edition of the DDC (in the four class areas selected by the participating libraries). For example, words from the DDC Schedules and notes, Relative Index, and first-listed subject headings in bibliographic records were indexed in the subject outline search to serve as pointers to the class number 658.3145.

DDC class number:	658.3145
Schedule captions:	Motivation, morale, discipline (from 658.314) Interpersonal relations (from 658.3145)
nin (including note):	Including informal, day-to-day relations between supervisors and subordinates
not (general note):	Promotion of effective working relationships between individuals and groups
Relative Index entry:	Interpersonal relations--employees--personnel administration--general management
First-listed subject headings:	Conflict management Executives Interpersonal relations--Study and teaching--Management Sexual harassment

Searchers could display all but the first-listed subject headings using the GN (Get detailed notes for a listed topic) option in DOC searches. We analyzed the full display to find out the numbers and percentages of the fields occurring in each display, the number of unique words contributed by each field in the display, and the overlap of words between the DDC and subject headings. The results of these analyses are presented in this section.

Table 73 contains summary statistics for the four different types of subject-rich notes in the DDC, four different cross-reference and relocation notes, DDC Schedule captions, DDC Relative Index entries, and first-listed subject headings. Table 73 also contains the total number of times each element occurred per DDC class number. For example, there were a total of 9,292 first-listed and different LC subject headings in the LC database linked to a total of 1,714 unique DDC class numbers. Thus, the average number of different subject headings linked to a unique DDC class number was 5.4 in the LC database. However, the range of different subject headings linked to a class number ranged from a low of 0 to a high of 440. The class number linked to this high of 440 different subject headings in the LC database was 338.2 (Extraction of minerals). The average number of different first-listed subject headings per class number was not one; thus, there was not a one-to-one correspondence between a first-listed subject heading and a DDC class number. The number of different subject headings linked to class numbers affected the performance of the subject outline search in DOC. When there were many subject headings linked to a class number, the searcher was directed to a class number where there were items on his topic of interest and on many other subjects. In the NYSL database, there were 236 different subject headings linked to the class number

974.7 (History of New York). This large number of subject headings adversely affected subject outline searches because the user who was directed to class number 974.7 found some titles on his topic of interest and many titles that were not on his topic of interest. Such subject outline searches were featured in sections 8.4.5 and 8.4.7.

The average number of Relative Index entries per unique DDC class number varied from library to library. At the University of Illinois, the average number of Relative Index entries was 2.21 and surpassed the average number of such entries at the three other libraries. The average number of Relative Index entries per unique DDC class number at PLCFC was 0.89, which was somewhat lower than the number of entries at UI. One reason for this difference in average numbers of Relative Index entries between libraries was the library's assignment of classification numbers. PLCFC classifiers assigned general class numbers to items on specific subjects, even though there was a specific class number to represent the item's subject, and did not use specific numbers in the DDC Schedules. Since these numbers were not used by the library, Relative Index entries were not processed into DOC because they would have been blind references in online subject searches. Thus, the library's assignment of classification numbers was in part responsible for the low average of 0.89 Relative Index entries per DDC number at PLCFC. (In examples of online searches in section 8.4.5, we showed how the library's assignment of classification numbers adversely affected subject outline searches.)

DDC Schedule captions and notes were processed into DOC regardless of the number of bibliographic records posted to a class number. The percentages of DDC Schedule captions that retrieved zero items were 39% at LC, 9% at NYSL, 49% at PLCFC, and 22% at UI. The numbers and average numbers of DDC Schedule captions and notes listed in table 73 include the "dummy" DDC class numbers and captions processed into the four libraries' databases with trailing zeros, which were needed in DOC to automatically generate Lists of Topics for class numbers such as 796.33206 and 516.02 (see section 4.3.2.3).

There was one DDC Schedule caption per unique class number; thus, the average number of Schedule captions per class number was one in each of the four DOC databases. The average number of subject-rich notes per DDC class number varied from library to library. The LC and UI databases featured the most including notes. Example notes were most plentiful accompanying the DDC Schedule captions in the UI database. DDC Schedule captions in the NYSL database featured more class here notes than the databases of the three other libraries. General notes were most plentiful in the LC database. There were few cross-reference and relocation notes accompanying DDC Schedule captions, but they did occur in one or more of the four libraries' databases.

Table 73. Average Number of First-listed Subject Headings, Relative Index Entries, and Schedule Notes Linked to a Unique DDC Number and Caption

	Unique Class Numbers and DDC Schedule Captions	First-listed LC Subject Headings	DDC Relative Index Entries	nin	nex	nch	not	nrl	ndn	nsx	nop
LC											
Total	1,714	9,292	1,710	178	49	103	235	14	22	14	27
Average	1.0	5.4	1.0	0.10	0.03	0.06	0.14	0.008	0.01	0.008	0.02
Range	1	0-440[a]	0-16[b]	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
NYSL											
Total	183	3,024	228	5	0	28	1	1	0	0	3
Average	1.0	16.5	1.25	0.02	0	0.15	0.006	0.006	0	0	0.02
Range	1	0-236[c]	0-7[d]	0-1	0	0-1	0-1	0-1	0	0	0-1
PLCFC											
Total	725	3,438	646	34	30	10	32	1	0	4	0
Average	1.0	4.7	0.89	0.05	0.07	0.01	0.04	0.001	0	0.005	0
Range	1	0-254[e]	0-13[f]	0-1	0-1	0-1	0-1	0-1	0	0-1	0
UI											
Total	287	2,174	635	30	27	28	0	1	1	0	0
Average	1.0	7.6	2.21	0.10	0.09	0.10	0	0.004	0.004	0	0
Range	1	0-408[g]	0-21[h]	0-1	0-1	0-0	0	0-1	0-1	0	0

[a] (338.47) Goods and services
[b] (338.2) Extraction of minerals
[c] (974.7) History of New York
[d] (917.4753) History of Essex County;
(974.753) Geography of and travel in Essex County
[e] (791.4309) Standard subdivisions (Motion pictures)
[f] (794.2) Other board games
[g] (510) Mathematics
[h] (512.55) Topological and related algebras

Key:
nin = Including note
nex = Example note
nch = Class here note
not = General note
nrl = Relocation note
ndn = Discontinued note
nsx = Standard subdivisions exceptions note
nop = Optional provisions note

The percentages of Relative Index entries bearing the same DDC number as a DDC Schedule caption were determined before we processed the former into the experimental online catalog for each of the participating libraries. Thus, these percentages were not dependent on libraries' assignment of classification numbers. The percentages of DDC class numbers in the 19th edition of the DDC without Relative Index entries are the following:

1. LC (330-339, 380-382, 658): 46.2%
2. NYSL (917.47-917.4799, 973.1-973.2, 974.7-974.799): 11.5%
3. PLCFC (790-799): 51.3%
4. UI (510-519): 19.5%

These percentages varied among the four participating libraries whose selected class number areas represented different subject areas. In an analysis of LC class numbers and index entries, Immroth (1971) found that the percentages of index entries bearing the same LC class number as an LC Schedule caption varied among subject areas in the LC classification.

In the processing of Relative Index entries into DOC, Relative Index entries were not processed into DOC when they did not match a DDC number in the 19th edition of the DDC (see section 4.3.3.1).

Not every Relative Index entry in the 19th edition of the DDC was represented by a class number and caption in the Schedules. The percentages of Relative Index entries whose class numbers do not match a Schedules class number are listed below and vary among the four subject areas selected by the participating libraries. These percentages of Relative Index entries were obtained after entries were processed into DOC and entries were discarded that directed searchers to Schedules class numbers with zero postings.

1. LC (330-339, 380-382, 658): 11.1%
2. NYSL (917.47-917.4799, 973.1-973.2, 974.7-974.799): 0%
3. PLCFC (790-799): 29.9%
4. UI (510-519): 16.6%

Nearly 30% of Relative Index entries were not matches of DDC numbers in the DDC Schedules of the 19th edition within the subject areas chosen by PLCFC. Every class number in the ranges selected by NYSL was represented by at least one Relative Index entry, but these NYSL entries were created differently from the entries for the three other libraries. Only the Relative Index entries for the range 973.1-973.2 were taken directly from the 19th edition of the DDC Relative Index. The entries from the ranges 917.47-917.4799 and 974.7-974.799 were specially produced by Inforonics, which added a 91 and a 9 to Relative Index entries with the "area-" designation and class numbers beginning with 747 and inserted the phrase "Geography of and travel" after the text of an entry beginning with 917.47 or inserted the phrase "History" after the text of an entry beginning with 974.7.

The statistics in table 73 were useful for telling us how many subject headings and Relative Index entries are links to class numbers. Given the large number of different subject headings which were links to certain DDC numbers, it was not surprising that subject outline searches often referred searchers to class numbers where there were many items retrieved that were nonrelevant to the searcher's expressed topic (sections 8.4.5 and 8.4.7). These statistics also showed that there were few subject-rich Schedule notes per class number. When subject searchers displayed these notes, they expressed disappointment that there were so few notes per number and called for more notes (section 5.6.5, item 5).

The statistics in table 74 show the average number of words in first-listed subject headings, Relative Index entries, and Schedule captions and notes per class number. There are two columns for the three sources of subject-rich words (i.e., first-listed subject headings, Relative Index entries, and Schedule captions and notes). The first column lists the average number of words per class number before duplicate words are deleted and after stopwords are deleted (see appendix E). The second column lists the average number of words per class number after duplicate words are deleted. For example, there were an average of 22.6 words in the first-listed subject headings of LC records linked to a class number before duplicate words were deleted. After these duplicate words were deleted, the first-listed subject headings in LC bibliographic records contributed an average of 10.6 unique words as links to class numbers. According to the statistics in table 74, first-listed subject headings contributed the greatest number of unique subject-rich words per class number (10.9), Schedule captions and notes contributed the second greatest number of subject-rich words per class number (4.5), and the Relative Index contributed the smallest number of subject-rich words (2.9) of the three sources. The average number and range of unique words in first-listed subject headings varied much more than the average number and range of unique words in Relative Index entries and Schedule captions and notes. The greatest number of words contributed by a single source was at LC where there were 520 unique words in first-listed subject headings for the class number 338.47.

Table 74. Words in First-listed Subject Headings, Relative Index Entries, and Schedule Captions and Notes per Class Number

		First-listed Subject Heading Words before Duplicate Words Deleted	Unique Words in First-listed Subject Headings	Relative Index Entry Words before Duplicate Words Deleted	Unique Words in Relative Index Entries	Schedule Caption and Note Words before Duplicate Words Deleted	Unique Words in Schedule Captions and Notes
LC (number of unique DDC class numbers = 1,714)	Total	38,806	18,114	6,986	4,954	8,967	8,422
	Average	22.6	10.6	4.1	2.9	5.2	4.9
	Range	0-1,809[a]	0-520[a]	0-88[b]	0-33[b]	0-44[c]	0-38[c]
NYSL (number of unique DDC class numbers = 183)	Total	10,648	4,992	1,229	975	803	778
	Average	58.2	27.3	6.7	5.3	4.4	4.3
	Range	0-962[d]	0-326[e]	0-42[f]	0-17[f]	0-15[g]	0-14[g]
PLCFC (number of unique DDC class numbers = 725)	Total	10,068	5,596	2,013	1,494	2,127	2,077
	Average	13.9	7.7	2.8	2.1	2.9	2.9
	Range	0-885[h]	0-314[h]	0-33[i]	0-18[i]	0-20[i]	0-18[i]
UI (number of unique DDC class numbers = 287)	Total	5,303	2,949	1,675	1,100	1,087	1,006
	Average	18.5	10.3	5.8	3.8	3.8	3.5
	Range	0-1,103[j]	0-468[j]	0-62[k]	0-23[k]	0-26[l]	0-20[m]
(Total number of unique DDC class numbers = 2,909)	Total	64,825	31,651	11,903	8,523	12,984	12,283
	Average	22.3	10.9	4.1	2.9	4.5	4.2

[a] (338.47) Goods and services
[b] (338.2) Extraction of minerals
[c] (658) General management
[d] (974.7) History of New York
[e] (917.47) Geography of and travel in New York
[f] (917.4753) Geography of and travel in Essex County
[g] (973.22) Other early settlements, 1620-1643
[h] (791.4309) Standard subdivisions (motion pictures)
[i] (794.2) Other board games
[j] (510) Mathematics
[k] (516.362) Global differential geometry
[l] (515.73) Topological vector spaces
[m] (512.55) Topological and related algebras

Table 75 shows a comparison of the overlap in unique words in first-listed subject headings, Relative Index entries, and Schedule captions and notes. In the first column, the percentages of unique Relative Index entry words duplicated by unique words in the DDC Schedules and notes are given. In the NYSL and UI databases, about three of every five unique words in a Relative Index entry were duplicated by unique words in the DDC Schedules. In the second column, the percentages of unique words in Schedule captions and notes duplicated by unique words in Relative Index entries are listed. The greatest amount of overlap between these two sources was in the NYSL and UI databases. Less overlap between the Schedules and Relative Index was recorded in the LC and PLCFC databases. One reason for the lesser amount of overlap between the Relative Index and Schedules in the LC and PLCLC databases was the automatic expansion of ranges of Schedule records (see section 4.3.2.2) and the creation of dummy records (see section 4.3.2.3). This automatic expansion of ranges and creation of dummy records resulted in at least a 25% increase in the number of Schedule records when Schedule records received from Inforonics were processed into DOC for LC and PLCFC (see table 2). Most of these new Schedule records would not have been described by a Relative Index entry because they were not enumerated in the printed DDC and were created for searching the DDC in DOC. Thus, there would have been no overlap between these new Schedule records and Relative Index entries because there were no Relative Index entries to compare with the new Schedule records.

Table 75. Overlap in Unique Words in the DDC and First-listed Subject Headings

	Percentage of Unique Relative Index Entry Words Duplicated by Unique Schedule Caption and Note Words	Percentage of Unique Schedule Caption and Note Words Duplicated by Unique Relative Index Entry Words	Percentage of Unique Words in Schedule Captions and Notes and Relative Index Entries Duplicated by Unique Subject Heading Words	Percentage of Unique Subject Heading Words Duplicated by Words in Schedule Captions and Notes and Relative Index Entries
LC (number of unique DDC class numbers = 1,714)	46.8%	28.3%	12.3%	7.5%
NYSL (number of unique DDC class numbers = 183)	62.1%	77.8%	47.3%	10.9%
PLCFC (number of unique DDC class numbers = 725)	22.1%	36.8%	18.3%	13.7%
UI (number of unique DDC class numbers = 287)	61.5%	67.2%	35.4%	17.2%

The third column shows the percentage of unique words in the DDC, i.e., Relative Index entries and Schedule captions and notes, duplicated by unique words in first-listed subject headings in bibliographic records. The percentage of overlap varied from subject area to subject area but did not exceed 50%. The fourth column lists the percentages of unique words in first-listed subject headings duplicated by unique words in the DDC. These percentages representing the overlap of first-listed subject headings by the DDC were the lowest in this analysis.

9.3 Fields in Enhanced Bibliographic Records in DOC

Bibliographic records in a MARC or MARC-like format were obtained from the four participating libraries. Only those fields and subfields whose contents were used for indexing, display, and/or processing in SOC and DOC were kept in bibliographic records in the experimental online catalog. MARC fields and subfields selected for inclusion in bibliographic records in SOC and DOC were listed in the "Source" column of table 5 for SOC and in the "Source" column of table 6 for DOC. In table 76, the different fields in DOC bibliographic records are listed along with the total number of fields in the library's database, average number of fields per bibliographic record, and the percentage of records without these fields in the database. The NYSL database had the largest percentage of records (35.98%) without subject headings. When DDC Schedule captions were added to and displayed in NYSL records, they added subject information and often provided context to help the user determine what the book was about. For example, the subject of this item entitled *Queen of the Lakes* would not have been readily apparent without the inclusion of the Dewey subject field.

DEWEY NUMBER	917.4797L71
COLLECTION	C
TITLE	Queen of the lakes.
DEWEY SUBJECT	Geography of and travel in Western counties. Geography of and travel in Buffalo.
AUTHOR	Lidstone, James Torrington Spencer.
PUBLISHER	1952

The average numbers of subject headings per PLCFC and UI bibliographic record (1.41 and 1.46) were comparable to the average number of subject headings (1.4) found in similar studies (Atherton 1978; O'Neill and Aluri 1979; McClure 1976). Disregarding the 36% of NYSL records that had no subject headings, the remaining 64% of records in the NYSL database had an average of 1.8% subject headings per record. The LC records had the most subject headings per record--2.26. Twenty percent of LC records and 23% of PLCFC records were not enhanced by Relative Index entries. This means that over 20% of LC and PLCFC bibliographic records were not retrievable by selecting a Relative Index entry in an alphabetical search and displaying bibliographic records. Only 1% of UI records were not enhanced with Relative Index entries and could not be accessed through Relative Index entries. All records in the four libraries' databases had been enhanced with a DDC Schedule caption. The automatic process of enhancing records with DDC Schedule captions was described in section 4.4.3.2. This process made certain that all database records were automatically assigned a DDC Schedule caption even if the record's class number did not match a class number in the DDC Schedules. Approximately three-quarters of LC and UI records contained notes from the DDC Schedules. The percentages of records containing the remaining fields show that most SOC and DOC records had a DDC call number, author, title, and publisher field. Some records had an edition, series, and sponsor field.

Table 76. Average Numbers and Percentages of Fields in SOC and DOC Bibliographic Records

	Library of Congress Field Counts:			New York State Library Field Counts:		
Field	Total	Average per Record	Without Field % in Database	Total	Average per Record	Without Field % in Database
DDC Relative Index Entry	24,288	2.05	20.48	12,079	1.48	11.70
DDC Caption	11,865	1.00	0.00	8,144	1.00	0.00
DDC Notes	16,952	1.43	27.70	2,690	0.33	70.38
LC Subject	26,827	2.26	0.04	9,322	1.14	35.98
Edition	1,143	0.10	90.37	126	0.02	98.45
DDC Call Number	11,865	1.00	0.00	8,144	1.00	0.00
Author	16,704	1.41	8.82	7,365	0.90	22.08
Sponsor	422	0.04	96.47	2,354	0.29	76.61
Alternate Title	247	0.02	97.96	25	0.00	99.72
Title	11,865	1.00	0.00	8,144	1.00	0.00
Publisher	11,865	1.00	0.00	7,895	0.97	3.06
Series Title	0	0.00	100.00	7	0.00	99.91
Series	3,919	0.33	68.23	113	0.01	98.67
Contents	410	0.03	96.54	47	0.01	99.44
Genre	0	0.00	100.00	0	0.00	100.00
Subheading	102	0.01	99.23	NA	NA	NA
Title Added	1,702	0.14	87.75	128	0.02	98.53
Series Added	1,530	0.13	87.43	3	0.00	99.96
DDC Class Number	81,479	6.87	0.00	29,320	3.60	98.45
LC Call Number	11,865	1.00	0.00	NA	NA	NA
Collection	NA	NA	NA	9,414	1.10	0.00

Library of Congress	New York State Library
Number of bib. records = 11,865	Number of bib. records = 8,144
Number of fields = 235,050	Number of fields = 105,320

Note: DDC Relative Index entry and Schedule caption and notes fields are not in SOC records.

Table 76. Average Numbers and Percentages of Fields in SOC and DOC Bibliographic Records (cont.)

	Public Library of Columbus and Franklin County Field Counts:			University of Illinois Field Counts:		
Field	Total	Average per Record	Without Field % in Database	Total	Average per Record	Without Field % in Database
DDC Index Entry	14,663	1.51	23.27	25,444	3.48	1.34
DDC Caption	9,719	1.00	0.00	7,316	1.00	0.00
DDC Notes	3,844	0.40	62.13	8,692	1.19	22.12
LC Subject	13,720	1.41	2.76	10,656	1.46	0.70
Edition	2,232	0.23	77.03	1,027	0.14	85.96
DDC Call Number	9,719	1.00	0.00	7,316	1.00	0.00
Author	12,416	1.28	1.18	9,609	1.31	2.36
Sponsor	0	0.00	100.00	279	0.04	96.25
Alternate Title	212	0.02	97.84	219	0.03	97.06
Title	9,719	1.00	0.00	7,316	1.00	0.00
Publisher	9,719	1.00	0.00	7,316	1.00	0.00
Series Title	2	0.00	99.98	0	0.00	100.00
Series	197	0.02	98.02	2,654	0.36	64.80
Contents	201	0.02	97.93	357	0.05	95.17
Genre	0	0.00	100.00	0	0.00	100.00
Subheading	156	0.02	99.17	191	0.03	98.93
Title Added	696	0.07	93.28	320	0.04	96.10
Series Added	7	0.00	99.94	548	0.07	92.77
DDC Class Number	34,760	3.58	0.00	16,269	2.22	0.00
LC Call Number	NA	NA	NA	NA	NA	NA
Collection	NA	NA	NA	NA	NA	NA
Number of bib. records = 9,719 Number of fields = 121,982				Number of bib. records = 7,316 Number of fields = 105,529		

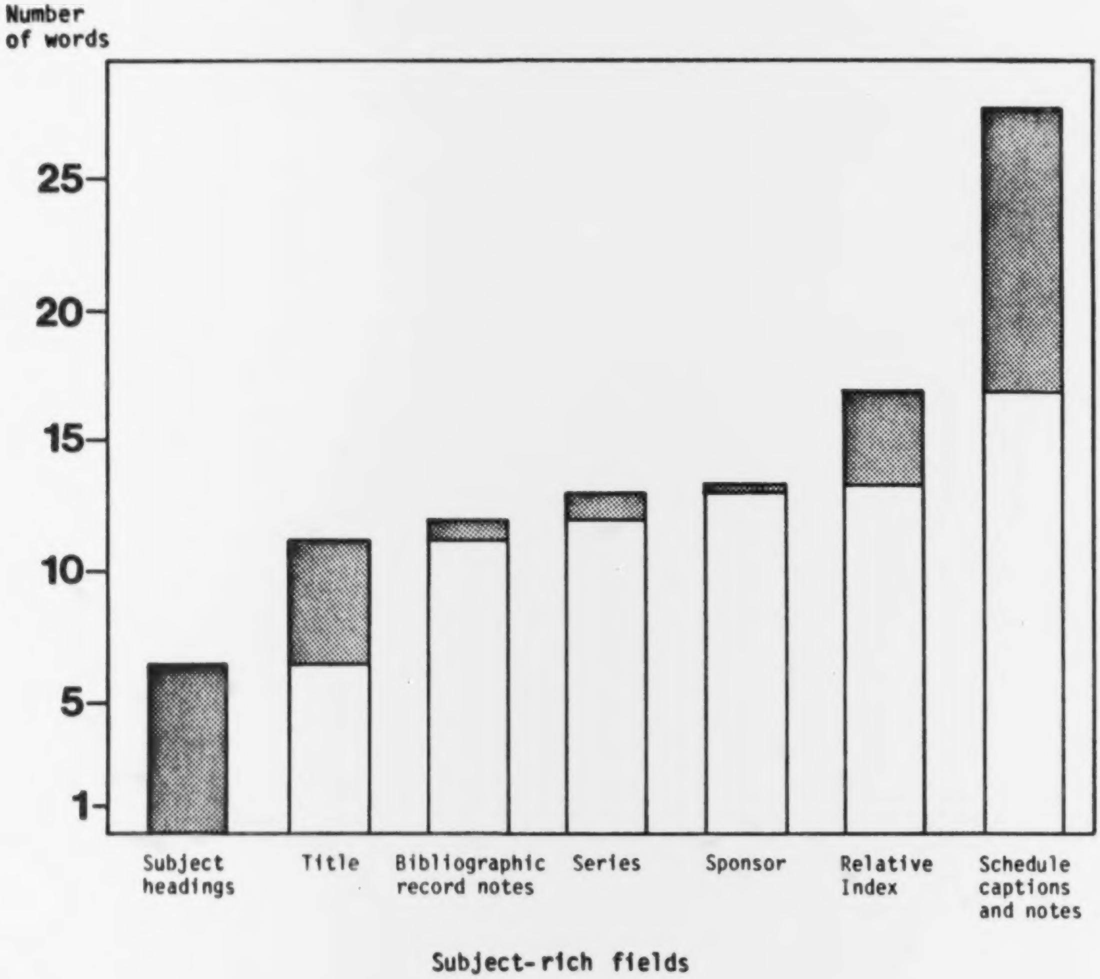
Bibliographic records in DOC were enhanced with DDC Schedule captions and notes and Relative Index entries. Although Schedule notes and Relative Index entries were not displayed in bibliographic records, their contents were processed into the searchable indexes for the direct and subject outline searches. A bibliographic record enhanced with the DDC was actually stored in DOC with fields added from the DDC (see fig. 48). The contents of the subject-rich fields in bibliographic records from each of the four libraries were analyzed to determine the average number of unique words contributed successively by subject-rich fields. This analysis required the calculation of the number of words per field. These words were then compared to one another, and duplicate words per field were discarded. The results of this preliminary analysis are shown in appendix O. Thirty-six percent of the words in Relative Index entry fields were duplicate words, and 23% of the words in subject headings were duplicate words. The title and sponsor fields resulted in the smallest number of duplicate words. This analysis continued with the calculation of the number of unique words contributed successively by the seven subject-rich fields in bibliographic records. The results of this analysis are shown in tables 77-79.

In table 77, the results of the analysis are given for each of the four libraries when the subject heading field is first in the analysis and Schedule caption and note field is last. For LC records, the subject headings contributed an average of 6.23 unique words and the title contributed an average of 5.08 unique words The (bibliographic record) notes, series, and sponsor fields contributed a total of 2.17 unique words; the Relative Index entries contributed 4.23 unique words; and the Schedule captions and notes contributed 10.19 unique words. Even though the Schedule's contribution of unique words was last in the sequence, it contributed more unique terms than subject headings in the LC records and more unique terms than subject headings in the three other libraries' records in the analysis. The bar graph in fig. 49 shows the successive contribution of unique words by subject-rich fields from DOC's LC database. At least one-third of the subject-rich words in DOC bibliographic records were contributed by the Schedule captions and notes in LC and PLCFC records. Over one-third of the subject-rich words were contributed by the DDC Relative Index and Schedule captions and notes in the records of all four participating libraries.

We reversed the sequence of fields in the analysis of unique words contributed successively by subject-rich fields in DOC bibliographic records. In table 78, the results of this analysis are given for each of the four libraries for the subject-rich fields in this order: (1) DDC Schedule captions and notes; (2) Relative Index entries; (3) sponsor; (4) series; (5) (bibliographic record) notes; (6) title; (7) subject headings; and (8) the total of 1-7. In this analysis, the subject headings contained only 13% or less of the total percentage of subject-rich words in bibliographic records. The greatest contribution came from the DDC Schedules, which contributed between 40% and 49% of the subject-rich words in the bibliographic record.

CALL NUMBER	515.35 Sch2p, 1981
AUTHOR	Martini, R. (Rodolfo), 1943- Jager, E. M. de (Eduardus Marie de)
SPONSOR	Scheveningen Conference on Differential Equations (5th : 1981)
TITLE	Geometric techniques in gauge theories: proceedings of the Fifth Scheveningen Conference on Differential Equations, the Netherlands, August 23-28, 1981
PUBLISHER	Berlin ; New York : Springer-Verlag, 1982.
SERIES	Lecture notes in mathematics
LC SUBJECT	Gauge fields (Physics)--Congresses Geometry, Differential--Congresses
SERIES ADDED	Lecture notes in mathematics (Springer-Verlag)
RELATIVE INDEX ENTRY	Boundary-value problems Boundary-value problems--differential equations Differential--equations
DEWEY SUBJECT	Differential calculus and equations. Differential equations.
CLASS HERE NOTE	Also orders, degrees, comprehensive works on boundary-value problems.

Fig. 48. Bibliographic record display in DOC without suppression of Schedule notes and Relative Index entries



NOTE: Darkened portion of bar represents the number of unique words contributed by this field. White portion of bar represents number of unique words already contributed by fields listed to the left of the bar.

Fig. 49. Successive contributions of unique words by subject-rich fields in DOC's LC database

Table 77. Successive Contributions of Unique Words in Subject-rich Fields of Bibliographic Records

	Subject Headings	Title	(Bibliographic Record) Notes	Series	Sponsor	Relative Index Entries	Schedule Captions and Notes	Total
LC								
Total unique words	73,925	60,234	8,342	16,300	1,109	50,244	120,889	331,043
Average	6.23	5.08	0.70	1.38	0.09	4.23	10.19	27.90
Percentage of total	22%	18%	3%	5%	0.3%	15%	37%	100%
NYSL								
Total unique words	28,021	54,095	429	392	4,924	25,806	25,258	138,925
Average	3.44	6.64	0.05	0.05	0.61	3.17	3.10	17.06
Percentage of total	20%	39%	0.3%	0.3%	4%	19%	18%	100%
PLCFC								
Total unique words	30,225	31,279	2,778	512	0	21,768	42,978	129,540
Average	3.11	3.22	0.29	0.05	0	2.24	4.42	13.33
Percentage of total	24%	24%	2%	0.4%	0	17%	33%	100%
UI								
Total unique words	21,750	36,353	4,118	10,509	600	29,594	22,633	125,557
Average	2.97	4.97	0.56	1.44	0.08	4.05	3.09	17.16
Percentage of total	17%	29%	3%	8%	0.5%	24%	18%	100%
Grand total of unique words	153,921	181,961	15,667	27,713	6,633	127,412	211,758	725,065
Average	4.15	4.91	0.42	0.75	0.18	3.44	5.72	19.57
Percentage of grand total	21%	25%	2%	4%	1%	18%	29%	100%

Table 78. Successive Contributions of Unique Words in Subject-rich Fields (Reversed) in Bibliographic Records

	Schedule Captions and Notes	Relative Index Entries	Sponsor	Series	(Bibliographic Record) Notes	Title	Subject Headings	Total
LC								
Total unique words	161,082	28,484	2,893	17,940	8,860	68,331	43,453	331,043
Average	13.58	2.4	0.24	1.51	0.75	5.76	3.66	27.90
Percentage of total	49%	9%	1%	5%	3%	21%	13%	100%
NYSL								
Total unique words	55,851	12,457	7,677	408	479	50,723	11,330	138,925
Average	6.86	1.53	0.94	0.05	0.06	6.23	1.39	17.06
Percentage of total	40%	9%	5	0.3%	0.4%	36%	8%	100%
PLCFC								
Total unique words	61,175	12,806	0	553	2,984	35,843	16,179	129,540
Average	6.29	1.32	0	0.06	0.31	3.69	1.66	13.33
Percentage of total	47%	10%	0	1%	2%	28%	12%	100%
UI								
Total unique words	54,844	8,652	1,546	10,687	4,431	36,406	8,991	125,557
Average	7.5	1.18	0.21	1.46	0.60	4.98	1.23	17.16
Percentage of total	44%	7%	1%	8%	4%	29%	7%	100%
Grand total of unique words	332,952	62,399	12,116	29,588	16,754	191,303	79,953	725,065
Average	8.99	1.68	0.33	0.80	0.45	5.16	2.16	19.57
Percentage of grand total	46%	9%	2%	4%	2%	26%	11%	100%

Table 79. Successive Contributions of Unique Words in Subject-rich Fields of Bibliographic Records (without Subject Headings)

	Title	(Bibliographic Record) Notes	Series	Sponsor	Relative Index Entries	Schedule Captions and Notes	Total
LC							
Total unique words	80,792	8,787	17,842	1,592	57,443	141,182	307,638
Average	6.81	0.74	1.50	0.14	4.84	11.90	25.93
Percentage of total	26%	3%	6%	1%	18%	46%	100%
NYSL							
Total unique words	64,614	448	431	5,317	30,831	25,943	127,584
Average	7.93	0.06	0.05	0.65	3.79	3.18	15.66
Percentage of total	51%	0.4%	0.3%	4%	24%	20%	100%
PLCFC							
Total unique words	41,128	2,850	545	0	25,020	43,818	113,361
Average	4.23	0.29	0.06	0	2.57	4.51	11.66
Percentage of total	36%	2.5%	0.5%	0	22%	39%	100%
UI							
Total unique words	42,005	4,175	10,680	622	35,524	23,560	116,566
Average	5.74	0.57	1.46	0.09	4.85	3.22	15.93
Percentage of total	36%	4%	9%	1%	30%	20%	100%
Grand total of unique words	228,539	16,312	29,585	7,732	150,274	250,238	682,680
Average	6.17	0.44	0.80	0.21	4.06	6.75	18.43
Percentage of grand total	34%	2%	4%	1%	22%	37%	100%

We analyzed the contributions of unique words from subject-rich fields and left out the subject headings in this analysis because there are libraries whose records do not contain subject headings. The results of this analysis are shown in table 79. There were fewer subject-rich words per record and the differences between the total (average) number of unique subject-rich words in records with subject headings and the total (average) number of unique subject- rich words in bibliographic records without subject headings were 1.97 words (LC), 1.4 words (NYSL), 1.67 words (PLCFC), and 1.23 words (UI). Most unique subject-rich words came from the title, Relative Index entries, and Schedule captions and notes in bibliographic records when subject headings were dropped from the analysis. Libraries whose records do not contain subject headings should consider integrating a library classification schedule and index into the online catalog, since the classification is a major contributor of subject-rich words.

The statistics in tables 77, 78, and 79 suggest that the DDC was a major contributor of subject-rich words to DOC bibliographic records. We were not entirely comfortable with this strong performance of the DDC as a contributor of subject-rich words because of the number of dummy captions in the LC and PLCFC Schedules (see table 2), expanded ranges of Schedule captions in the LC and PLCFC databases, and searchers' negative experiences with these dummy captions and expanded ranges of captions in online retrieval tests (see section 8.4.7). Therefore, we analyzed a random sample of the four libraries' bibliographic records to determine whether the DDC record enhancement was a satisfactory or unsatisfactory indicator of an item's subject contents. In the analysis, unique terms contributed by the Schedules and Relative Index were described by one of five satisfactory categories or one of three unsatisfactory categories:

A. Satisfactory indicator of an item's subject contents
    1. Broader than the item's subject contents
    2. Narrower than the item's subject contents
    3. Related to the item's subject contents
    4. Same as the item's subject contents
    5. Not A.1-4, but the term is a satisfactory indicator

B. Unsatisfactory indicator of an item's subject contents
    1. Contrived or awkward terminology used
    2. Nonsubject information from the Schedules
    3. Information added to the Schedules by the DDC Online Project that is contrived or awkward or does not describe an item's subject contents

Tables 80 and 81 list the average number of unique terms contributed by the Schedules and Relative Index after the unique terms were categorized into satisfactory and unsatisfactory indicators of subject content. In table 80 there is a column for each library labeled "Schedules," which lists the average number of unique terms contributed by the Schedules when they are considered *last* in the analysis of unique terms (following the sequence of subject-rich fields in table 77). The column labeled "Relative Index" lists the average number of unique terms contributed by the Relative Index when it is considered *second to last* in the analysis of unique terms (following the sequence of subject-rich fields in table 77). In table 81 the columns labeled "Schedules" list the average number of unique terms contributed by the Schedules when they are considered *first* in the analysis of unique terms (following the sequence of subject-rich fields in table 78). The columns labeled "Relative Index" list the average number of unique terms contributed by the Relative Index when it is considered *second* in the analysis of unique terms (following the sequence of subject-rich fields in table 78).

Table 80. DDC as an Indicator of an Item's Subject Contents

	LC Schedules	LC Relative Index	NYSL Schedules	NYSL Relative Index	PLCFC Schedules	PLCFC Relative Index	UI Schedules	UI Relative Index
A. Satisfactory indicator of an item's subject contents								
1. Broader than the item's contents	3.15	3.28	1.74	0.42	1.17	1.21	0.53	1.15
2. Narrower than the item's subject contents	0.11	0.02	0.15	0.11	0.02	0.11	0	0.04
3. Related to the item's subject contents	1.04	0.30	0.05	0.21	0.59	0.21	0.58	0.28
4. Same as the item's subject contents	0.22	0.05	0.12	0.27	0.12	0.27	0.08	0.26
5. Not A.1-4, but the term is a satisfactory indicator	1.09	1.10	1.41	0.21	0.32	0.21	1.18	1.74
Subtotal	5.61	4.75	3.47	1.22	2.22	2.01	2.37	3.47
B. Unsatisfactory indicator of an item's subject contents								
1. Contrived or awkward terminology used	0.93	0.04	0.05	0	0.79	0	0.08	0.04
2. Nonsubject information from Schedules	0.25	0	0	0	0.70	0	0	0
3. Information added to Schedules	0.73	0	0	0	0.87	0	0.14	0
Subtotal	1.91	0.04	0.05	0	2.36	0	0.22	0.04
Total in sample*	7.52	4.79	3.52	1.22	4.58	2.01	2.59	3.51
Total in entire database (see also table 77)	10.19	4.23	3.10	3.17	4.42	2.24	3.09	4.05

Note: Numbers in columns represent the average number of unique terms contributed by the Schedules and Relative Index when Schedules and Relative Index are last and next to last in the analysis.

*Number of records in each sample were (1) 96 (LC); (2) 78 (NYSL); (3) 98 (PLCFC); and (4) 74 (UI).

Table 81. DDC as an Indicator of an Item's Subject Contents (Reversed)

	LC Schedules	LC Relative Index	NYSL Schedules	NYSL Relative Index	PLCFC Schedules	PLCFC Relative Index	UI Schedules	UI Relative Index
A. Satisfactory indicator of an item's subject contents								
1. Broader than the item's contents	5.01	2.02	3.74	0.83	1.72	0.91	2.22	0.28
2. Narrower than the item's subject contents	0.14	0.02	0.46	0.04	0.06	0.07	0.68	0
3. Related to the item's subject contents	1.85	0.16	0.15	0.05	0.93	0.02	0.95	0.08
4. Same as the item's subject contents	0.54	0.04	0.35	0.03	0.65	0.10	1.03	0.04
5. Not A.1-4, but the term is a satisfactory indicator	1.38	0.65	2.37	0.64	0.38	0.11	2.59	0.30
Subtotal	8.92	2.89	7.07	1.59	3.74	1.21	7.47	0.70
B. Unsatisfactory indicator of an item's subject contents								
1. Contrived or awkward terminology used	0.98	0.04	0.05	0	0.80	0	0.08	0
2. Nonsubject information from Schedules	0.27	0	0	0	0.70	0	0	0
3. Information added to Schedules	0.74	0	0	0	0.87	0	0.14	0
Subtotal	1.99	0.04	0.05	0	2.37	0	0.22	0
Total in sample	10.91	2.93	7.12	1.59	6.11	1.21	7.69	0.70
Total in entire database (see also table 78)	13.58	2.40	6.86	1.53	6.29	1.32	7.50	1.18

Note: Numbers in columns represent the average number of unique terms contributed by the Schedules and Relative Index when Schedules and Relative Index are first and second in the analysis.

The analysis of contributed terms in table 77 showed that the Schedule contributed an average of 10.19 unique terms to LC bibliographic records when the Schedule was the last subject-rich field contributing unique terms to the analysis. When a sample of LC records was analyzed and their unique Schedule terms were categorized, the average number of unique terms was lower (7.52), but the majority of those unique terms were placed into categories that were satisfactory indicators of subject content (5.61 of 7.52 unique terms or 75%). Most of these satisfactory terms (3.15) were broader than the subject contents of the bibliographic record. In the unsatisfactory indicator category, about one unique term per bibliographic record was derived from a Schedule caption that was contrived or awkward in the context of the bibliographic record. Here are some samples:

Class Number	Schedule Caption(s)	Book Title
333.91	Other natural resources. Water and land adjoining it.	Water in the Santa Clara Valley: a history
331.8811	In specific industries and occupations and specific groups of industries and occupations. Other than extractive, manufacturing, construction.	From subservience to strike: industrial relations in the banking industry

Examples of Schedule captions added to LC records that were composed of nonsubject information are the following:

Class Number	Schedule Caption(s)	Book Title
337.09	Historical and geographic treatment.	Elements of world instability: armaments, communication, food
331.880911	Historical and geographical treatment. Treatment by areas, regions, places in general.	Working class hero: a new strategy for labor
338.604	Special topics of general applicability.	Submission of the Ontario Federation of Labour to the Select Committee on plant shutdowns and employee adjustment

There were unique terms in the Schedules that the DDC Online Project team automatically added to the bibliographic records based on procedures described in sections 4.3.2.3 and 4.3.2.4. The phrase, "General aspects. Examples: Journals, study and teaching," was automatically added to the records of all four libraries and was usually considered nonsubject information in the context of the bibliographic record. Other phrases, automatically added to LC bibliographic records by the DDC Online Project team (with consultation from the Decimal Classification Division), that were sometimes considered nonsubject information are the following:

Class Number	Schedule Caption(s)	Book Title
330.02	General aspects. Examples: Journals, study and teaching. Miscellany.	Global econometrics: essays in honor of Lawrence R. Klein
658.008	General aspects. Examples: Journals, study and teaching. With respect to specific groups of persons.	Japan's reluctant multinationals: Japanese management abroad and at home
380.106	General aspects. Examples: Journals, study and teaching. Organizations and management.	The bi-centennial handbook, 1779-1979
338.9009	General aspects. Examples: Journals, study and teaching. Historical and geographical treatment.	Development technology or informatics and industrial development

The analysis of contributed terms in table 78 showed that the Schedule contributed an average of 13.58 unique terms to LC bibliographic records when the Schedule was the first subject-rich field contributing unique terms to the analysis. When a sample of LC records was analyzed and their unique Schedule terms were categorized, the average number of unique terms was lower (10.91), but the majority of those unique terms were placed into categories that were satisfactory indicators of subject content (8.92 of 10.91 unique terms, or 82%). Examples of unique terms that were unsatisfactory indicators of subject content in LC bibliographic records have already been given.

The average numbers of unique terms from the Relative Index in LC bibliographic records when the Relative Index was second to last in the analysis of contributed terms (4.23, table 77) and was second in the analysis of contributed terms (2.4, table 78) were not much different from the average numbers of unique terms in the two samples (4.79, table 80, and 2.93, table 81). Nearly all of the unique terms contributed by the Relative Index to LC records were considered satisfactory indicators of an item's subject contents but broader than its contents.

Most of the unique terms contributed by the Schedules to NYSL bibliographic records were satisfactory indicators of content. A large portion of these terms were broader than the subject content of the bibliographic record in which they were contained. On the average, 2.37 unique terms (table 81) per record fell into a miscellaneous category that represented a satisfactory indicator of contents, but the judge of contents was unable to characterize the relationship between the unique term and the bibliographic record. Examples of such Schedule captions are provided below. Most occurred in records without assigned subject headings and provided the context of the geographical area covered by the book, which was not obviously apparent from the title of the item.

Class Number	Schedule Caption(s)	Book Title
974.728	History of Rockland County	History of the Reformed Church, Tappan, N.Y.
974.731	History of Orange County	Neelytown cemetery inscriptions on monuments
974.797	History of Buffalo	History of Trinity Church

The Schedules and Relative Index for NYSL had almost no occurrences of unique terms categorized into unsatisfactory indicators of subject content. The one Schedule caption in the sample judged contrived was "History of other parts of New York Metropolitan area," which was assigned to an item entitled Index to the wills, administrations, and guardianships of Kings County, New York, 1630 to 1850. The Schedules and Relative Index for NYSL were the only portions of the DDC used in the DDC Online Project that were specially prepared from the DDC Tables by Inforonics (see "DDC Tables," section 3.2).

About half of the unique terms contributed by the Schedules to PLCFC bibliographic records were satisfactory indicators of a record's subject content; these satisfactory indicators were usually broader than the record's subject content. About half of the unique terms contributed by the Schedules to PLCFC records were unsatisfactory indicators of a record's subject content. Examples of contrived Schedule information are the following:

Class Number	Schedule Caption(s)	Book Title
796.334	Inflated ball driven by foot. (Caption at 796.33 added to record)	The ABC of soccer sense: strategy and tactics today
793.7	Games not characterized by action. (Caption at 793.7 added to record)	Logic for beginners through games, jokes, and puzzles
796.323	Inflated ball thrown or hit by hand. (Caption at 796.32 added to record)	Basketball
791.3	Other than musical sport and game performances. (General note at 791)	Circus days
796.357	Ball driven by club, mallet, or bat. (Caption at 796.35 added to record)	Be a winner in baseball

Nonsubject information added to PLCFC bibliographic records from the Schedules was the phrase "Standard subdivisions." This phrase amounted to an average of 0.70 terms per record that were unsatisfactory indicators of subject contents in a total of 4.58 or 6.11 unique terms per record. PLCFC records automatically enhanced with the caption "General aspects. Examples: Journals, study and teaching" accounted for an average of nearly one term per record that was an unsatisfactory indicator of subject contents. PLCFC Relative Index entries were satisfactory indicators of subject contents.

Most of the unique terms in the Schedules and Relative Index added to UI bibliographic records were satisfactory indicators of subject content. UI records had a larger share of captions that were related to (table 80) or the same as (table 81) the bibliographic record's subject contents than captions at the three other libraries. One contrived Schedule caption was "Other analytical methods." The Schedule caption bearing nonsubject information that was automatically added to UI records, i.e., "General aspects: Journals, study and teaching" occurred in these records on occasion but not with the frequency of LC and PLCFC records.

This analysis of the categorization of unique terms contributed by the DDC showed that not all terms added by the DDC were satisfactory indicators of a book's subject contents. Generally, unique terms contributed by the Schedules that were a satisfactory indicator of subject contents were broader than a book's subject contents (regardless of the Schedules' contribution first or last in the sequence of subject-rich fields of bibliographic records). The NYSL and UI Schedules and Relative Index supplied few unique terms that were unsatisfactory indicators of a book's subject contents. The latter were taken directly from the Schedules and Relative Index, and most of the former were automatically generated from the DDC Tables.

The LC and PLCFC Schedules contributed about 25% and 52% unique terms, respectively, to bibliographic records (when the Schedules were last in the sequence of subject-rich fields contributing unique terms to bibliographic records) that were unsatisfactory indicators of a book's subject contents. These unsatisfactory indicators came directly from the Schedules. They were also added to records by the DDC Online Project team in our attempt to replace ambiguous Schedule captions with better ones. In view of their categorization as unsatisfactory indicators, our attempt to improve upon the wording of Schedules did not provide satisfactory results.

The results of the categorization of unique terms from the DDC made us curious about subject headings in bibliographic records. Using the same categorization scheme without two of the three unsatisfactory categories for Schedules, we categorized subject headings from the samples of participating libraries' records. The results of this analysis are shown in table 82. Few subject headings were characterized as unsatisfactory indicators of a book's subject contents. Most subject headings were considered satisfactory indicators of content. The largest number of unique terms in subject headings were considered the same as a book's subject contents. In both analyses (for unique terms in the DDC and in subject headings), the judge did not have the actual book in hand and had to base his decision on the information in the bibliographic record. Comparing the results of the two analyses, we can safely conclude that unique terms contributed by the DDC were often broader than a book's contents and unique terms contributed by subject headings expressed the same subject as a book. However, unique terms contributed by the DDC were sometimes unsatisfactory indicators of a book's subject contents, especially in the LC and PLCFC databases.

Table 82. Subject Headings as an Indicator of an Item's Subject Contents

	When Subject Headings Are First in the Analysis				When Subject Headings Are Last in the Analysis			
	LC Subject Headings	NYSL Subject Headings	PLCFC Subject Headings	UI Subject Headings	LC Subject Headings	NYSL Subject Headings	PLCFC Subject Headings	UI Subject Headings
A. Satisfactory indicator of an item's subject contents								
1. Broader than the item's subject contents	1.26	1.50	1.13	0.88	0.92	0.70	0.89	0.41
2. Narrower than the item's subject contents	0.38	0.59	0.21	0	0.29	0.43	0.15	0
3. Related to the item's subject contents	0.73	0.13	0.08	0	0.56	0.11	0.05	0
4. Same as the item's subject contents	4.20	3.30	2.05	1.55	2.30	1.41	1.07	0.55
5. Not A.1-4 but the term is a satisfactory indicator	0.18	0.91	0.27	0.93	0.17	0.54	0.21	0.63
Subtotal	6.75	6.43	3.74	3.36	4.24	3.19	2.37	1.59
B. Unsatisfactory indicator of an item's subject contents								
1. Contrived or awkward terminology used	0.02	0.09	0	0.12	0.01	0.09	0	0.10
Subtotal	0.02	0.09	0	0.12	0.01	0.09	0	0.10
Total in sample*	6.77	6.52	3.74	3.48	4.25	3.28	2.37	1.69
Total in entire database (see tables 77 and 78)	6.23	3.44	3.11	2.97	3.66	1.39	1.66	1.23

*Number of records in each sample were (1) 96 (LC); (2) 46 (NYSL); (3) 96 (PLCFC); and (4) 73 (UI). Fewer records were in this sample than samples for tables 80 and 81 because of records without subject headings.

The categorization of the DDC as a satisfactory or unsatisfactory indicator of a book's subject contents forces us to reinterpret the results of tables 77, 78, and 79, which showed the successive contributions of unique terms in subject-rich fields of bibliographic records. The contributions of unique subject-rich words by the Relative Index at all four libraries remain almost unchanged. The contributions of the Schedule to NYSL and UI records also stay the same. However, the contributions of the Schedules to LC and PLCFC records should be reduced by one-quarter and one-half respectively, in view of the large portions of unique terms that are unsatisfactory indicators of subject content.

In view of these results, DDC Schedule captions in certain identifiable areas of the Schedules require rewording to improve their understandability to online catalog users. Pretesting the rewording with online catalog users is advisable. The contribution of unique words by the DDC was comparable to and sometimes exceeded the contribution of unique terms by subject headings. Unique terms contributed by the DDC were usually more general than the book's contents, and subject headings expressed the book's contents more exactly than the DDC. This analysis of unique words demonstrated that the DDC was a major contributor of general subject-rich and unique terms of a book's contents. The analysis of retrieval test results in chapter 8 showed that the DDC also had the ability to provide new and fruitful strategies for subject searching that were not possible through the alphabetical and keyword searching permitted by existing online catalogs. Thus, the DDC enhanced subject access to bibliographic records and subject searching strategies in the experimental online catalog.

9.4 Decimal Classification Division Staff Use of the Experimental Online Catalog

The experimental online catalog was installed in the Decimal Classification Division (DCD) of the Library of Congress from May 7, 1985 to May 29, 1985. For most of this period, the experimental online catalog was available to DCD staff and other LC staff for online searching. When the system was first installed at DCD, project team staff trained a division staff member in online searching. This staff member trained other DCD staff to use the experimental online catalog on their own and/or demonstrated the system to other DCD staff.

DCD staff do not interact with any of the Library of Congress' end users; they are chiefly involved in classification of library materials and/or editorial tasks for the present and future editions of the Dewey Decimal Classification. Thus, we expected that their use of the experimental online catalog with its DDC online would probably be oriented toward their everyday work, which was very different from the type of searching done in a public services environment.

A memo was drawn up by the DDC Online Project staff and distributed to DCD staff that described the functions of the experimental online catalog and encouraged them to use the catalog during its installation in the division in connection with their editorial and/or classification work (see appendix P). A list of search topics and questions that DCD staff should think about while completing their online subject searches were provided.

On May 29, 1985, two project team members (K. Markey and L. Chan) visited the Decimal Classification Division of the Library of Congress to conduct focused-group interviews with division staff to learn their reaction to the DDC online. Specifically, we wanted to know the following:

1. How division staff used the DDC online in their classification work
2. How division staff used the DDC online in their editorial work
3. What improvements division staff wanted made to the experimental online catalog's features for providing subject access, browsing, and display of the DDC
4. What changes division staff would consider when formulating DDC Schedules in the future to make the DDC online more useful to library patrons searching the DDC in an online catalog environment

These four questions were listed in OCLC's proposal to CLR for the DDC Online Project (*The Dewey Decimal Classification as an Online Searcher's Tool for Subject Access, Browsing, and Display in an Online Public Access Catalog*, dated September 29, 1983). A list of questions was compiled by the focused-group interviewers and reviewed by project consultants and the Chief of the Decimal Classification Division prior to the interviews on May 29, 1985. The questions in the interview schedule covered five major areas. These areas and questions were the following:

1. Classification
    a. How did you use DOC to classify a book on one of the topics you searched?
    b. How did you use MUMS, SCORPIO, and SOC to classify a book on one of the topics you searched?
2. Subject searching
    a. Think back to the subject searches you performed in SOC and DOC. Tell us about your experiences.
    b. In what ways could DOC be improved to help users do better subject searching?
3. Editorial work
    a. What editorial tasks are facilitated by using DOC?
4. Enhancement for library patrons
    a. What changes may need to be made to the DDC to enhance its potential as an online tool for subject access, browsing, and display in an online catalog like DOC or MUMS or SCORPIO for use by library patrons?
    b. How has DOC changed your perception of how the DDC should be maintained and revised to benefit library patrons who can access the DDC in an online catalog (like DOC or MUMS or SCORPIO)?
5. Enhancement for library staff
    a. Would it make sense to add the DDC Schedules and Relative Index into a system like MUMS or SCORPIO so that you could search much the way you did on DOC whenever you wanted?
    b. What changes may need to be made to the DDC to enhance its potential as an online MUMS or SCORPIO tool for subject access, browsing, and display for your use?

The complete list of focused-group interview questions includes probes used by the interviewers to elicit staff comments and is found in appendix Q. DCD staff comments to focused-group interview questions were analyzed and compiled by the DDC Online Project team. Staff comments fell into five topical areas that answered the four questions originally presented in OCLC's proposal to CLR.

1. How Decimal Classification Division staff currently use MUMS and SCORPIO to classify an item
    a. In MUMS, classifiers enter a keyword title search and limit results to current library material. Then classifiers display retrieved items to find an appropriate DDC class number for the item in hand. (There was no direct DDC class number searching in MUMS during this study.)
    b. In SCORPIO, classifiers enter the subject heading listed on the manuscript sheet, i.e., subject heading(s) and LC class number assigned by the Subject Cataloging Division and descriptive cataloging assigned by the Descriptive Cataloging Division, and limit the results to items with DDC class numbers. If there are too many items, classifiers limit the results one more time to current material, i.e., material classed by the 19th edition of *DDC*. Then classifiers display retrieved items to find an appropriate DDC class number for the item in hand. (There was no direct DDC class number searching in SCORPIO during this study.)

2. How Decimal Classification Division staff would use DOC to classify an item
    a. The classifier has a class number in mind (given his familiarity with the DDC and subject of the item). He enters a class number into DOC through the SC (search for call number) option and displays items posted to the retrieved class number and caption to determine whether this number is appropriate for the book at hand.

3. How DOC must be improved to assist classifiers when classifying library material
    a. Add all Schedule notes into DOC so that the classifier does not have to consult the printed *DDC Schedules* at the online catalog.
    b. Add all Manual notes into DOC so that the classifier does not have to consult the printed *Manual on the Use of Dewey Decimal Classification* (Comaromi and Warren 1982) at the online catalog.
    c. Accelerate the display of the List of Topics (i.e., Schedule captions) in DOC because it is now quicker for the classifier to scan the printed page.
    d. Add the DDC Tables into DOC. Enlist windows for simultaneous displays of the DDC Schedules, Tables, and retrieved items.
    e. Alter the class number search in DOC so that items are retrieved for class numbers in the 19th edition of *DDC* and for built numbers.
    f. Alter the class number search in DOC so that the entry of a class number results in a display of the user-entered class number, Schedule caption, all Schedule and Manual notes, the number of items retrieved by the user-entered class number, and options to browse more general or more specific captions than the one displayed.
    g. Complete the display of DDC Schedule captions instead of truncating them after n characters.

4. The subject searching experiences of Decimal Classification Division staff
    a. The same user-entered topic obtains different results in each of the SOC and DOC subject searching options. Lack of familiarity with the experimental online catalog was cited by staff who felt that they could not predict ahead of time which subject search option would yield the best results (as they could often predict for MUMS and SCORPIO); consequently, they used all of the catalog's subject search options.
    b. The result of the subject outline search was disappointing for these reasons: (1) when it directs the searcher to a broad class number, e.g., 658 or 338, it gives little guidance beyond the asterisk (*) in the initial screen in what specific class number(s) items on the user-entered topic can be found; (2) there was no way to limit the results of a highly posted search by another term, current material, or language; and (3) there was no way to display the items that matched the user-entered term before displaying other items bearing the same class number.
    c. Classifiers liked the ability to search the DDC Schedules and Relative Index and the ability to enter DDC class numbers into the experimental online catalog. (1) In classification tasks, they would use the results of such searches to find a DDC class number assigned to an item like the one they were classifying.
    (2) Checking previous classification practice, they would use the results of such searches to determine whether items on a topic were scattered in different classification areas. When scattered topics were found, staff working in the affected subject areas would discuss the situation and resolve it, sometimes by adding a note to the Schedules or Manual.

5. Staff suggestions for improving subject searching in the experimental online catalog
    a. Direct searches in DOC often retrieved too many items. Display first the items whose subject heading, title, series, and bibliographic record note fields matched the user-entered term. Then display the items whose subject heading, title, series, note, DDC Schedule caption and notes, and Relative Index entry fields matched the user-entered term.
    b. Enhance the experimental online catalog with the ability to limit retrieved items by another term, language, and date of publication.
    c. Permit truncation.
    d. Allow Boolean searching.
    e. Integrate Relative Index entries into the alphabetical list of subject headings for bibliographic records but maintain separate postings for matched entries and subject headings. Although listing the same entry and subject heading in the alphabetical list may be confusing to patron searchers, these terms and their postings should be separate because the retrieved items are different but useful in different ways.
    f. Provide an alphabetical keyword-in-context display of the Relative Index. Then, matches of the user-entered term and Relative Index entries could be made on the innards of Relative Index entries.

6. Staff suggestions for improving the DDC for subject searching by library patrons
   a. Improve the Relative Index. As classifiers, the last place DCD staff consult for the class number of a topic is the Relative Index. They prefer asking a colleague or searching MUMS and SCORPIO to consulting the Relative Index. One reason they do not readily consult the Relative Index is that terms that classifiers want to enter are not listed in the Index. DCD staff suggested these improvements to the Relative Index: (1) frequently occurring subject headings (in a database of bibliographic records) could be added to the Index; (2) addition of more current and up-to-date terms to the Index; and (3) the elimination of hyphens in the online Relative Index by substituting phrases in place of indentions.
   b. Improve the terminology of the DDC Schedules. (1) Replace nonsubject captions, e.g., "Standard subdivisions," "Special topics of general applicability," by captions indicative of subject content. (2) Make captions more explicit of subject content, e.g., change "... in specific continents and countries" to "... in Asia." (3) Clarify captions under broad numbers, e.g., 338 or 658, with scope notes.
   c. Maintain centered headings and all notes associated with centered headings in online displays of the DDC Schedules.
   d. Integrate the DDC Tables into the online catalog.

7. Staff use of the experimental online catalog for editorial tasks
   a. The GN (get detailed notes for a listed topic) option allowed editorial staff to see simultaneously the DDC class number, Schedule caption, Schedule notes, and Relative Index entries. Such linking of the Schedule information and Relative Index entries could help them improve Relative Index entries.
   b. DOC featured both class number searching and the number of items retrieved per class number. This capability could assist editorial staff to find (1) overused numbers that need further subdivision and the introduction of new class numbers and (2) bibliographic records that were incorrectly assigned a class number so that the appropriate class number could be assigned to the record and an explanatory note could be added to the Schedules or Manual.
   c. Class number and subject outline searches result in an outline of DDC Schedule captions. This outline can help editorial staff to (1) detect and rectify structural problems in the DDC and (2) add notes to the Schedules or Manual to connect two class numbers during editorial revisions.

The focused-group interviews with DCD staff were a small but significant part of the DDC Online Project. Searching the experimental online catalog gave DCD staff an opportunity to identify and express their unique needs for online catalog capabilities that would help them in their classification and editorial work. With regard to the former, staff preferred the searching and limiting functions of MUMS and SCORPIO to DOC. To assist these staff, DOC needs to be enhanced with limiting capability, Boolean searching, and SOC's list of subject headings to enable them to do their job effectively. In chapter 8, patrons also called for such capabilities to improve the performance of their subject searches. Staff also wanted to see all the Schedule and Manual notes for each

DDC number and wanted the DDC Tables integrated into an online catalog. Then they would not have to consult on the printed versions of the DDC and Manual while classifying online. And they recognized that the display capability of the experimental online catalog was inadequate for their needs because they required simultaneous displays of the DDC Schedules, Tables, and retrieved items.

When DCD staff assumed the role of a patron searcher, they realized that terminology in the DDC Schedules and Relative Index was sometimes inadequate, contrived, and difficult to understand. They recommended ways in which this terminology could be improved. The most useful function of the experimental online catalog for classification and editorial tasks was the linkage of the bibliographic records to the Relative Index and DDC class numbers. This linkage would enable staff to identify a candidate class number(s) for a book in hand and to identify and rectify structural problems in the DDC. DCD staff recognized that the experimental online catalog was developed as a library patron's subject searching tool and identified many improvements in the catalog which would help them effectively accomplish their classification and/or editorial tasks.

9.5 Online Access to the DDC

Three functional areas of library work are served when classification information is available in machine-readable form: (1) editorial work, (2) classification work, and (3) subject retrieval of library materials by library patrons and staff (Cochrane and Markey 1985). The editor of the classification can maintain, edit, update, and produce the classification in a variety of forms. Forest Press and the Decimal Classification Division are now working together with Inforonics, Inc., to produce an automated editorial support system that will enable the editor to perform editorial tasks. Because of their work, we will not cover the editor's use of a machine-readable classification. Instead, we will focus on the two other uses of a machine-readable classification by library technical services staff performing classification tasks in an online cataloging system and library patrons performing subject searches in an online catalog.

The first step is to define a coding scheme for the class numbers in classification number fields of bibliographic records. This coding scheme will enable the integration of the DDC Tables into a centralized online cataloging system for library staff and an online catalog for library patrons and reference staff. Once this coding scheme is put into practice, library technical services staff involved in classification work would access the machine-readable files of their library classification through a centralized online cataloging system and apply the classification by using the most up-to-date version of the classification schedules, tables, and index, and the classification practice expressed by millions of cataloging records. As demonstrated in this study, subject retrieval of library materials by patrons and staff is enhanced by the integration of a library classification into the subject searching features of an online catalog. This section addresses the impact of a machine-readable classification on local online catalogs for subject retrieval by library patrons and staff (section 9.5.2) and on online cataloging systems for library classification work (section 9.5.3).

9.5.1 A Coding Scheme for Synthesized Numbers

The DDC Online Project focused on the DDC as a searcher's tool in an online catalog for subject access, browsing, and display. Only the DDC Schedules and Relative Index were incorporated into the experimental online catalog. Special coding in the individual elements of a synthesized class number would have enabled us to include the DDC Tables in the experimental online catalog. The first step, then, in the enhancement of bibliographic records with a library classification is the identification and implementation of a coding scheme for the individual elements of a synthesized class number in libraries' bibliographic records. A coding scheme is needed to identify the individual parts of a synthesized class number that are derived from the DDC Schedules and Tables. This coding scheme is necessary to integrate the DDC Tables into both centralized online cataloging and online catalog systems.

Wajenberg (1983, 250) has suggested a coding scheme for use in the 082 and 092 fields in bibliographic records. The scheme identifies the three ways in which DDC class numbers are synthesized: (1) numbers are added from the Tables, (2) numbers are added from the Schedules, and (3) numbers are added from special instructions throughout the Schedules. Wajenberg's scheme did not address the fourth way in which DDC numbers are synthesized, i.e., numbers are added from the Tables and period tables in the Schedules. The subfields and explanations of subfields in Wajenberg's coding scheme are the following:

Subfield	Explanation
a	The complete class number, as it would appear on books and in catalog records.
b	Book number.
e	That portion of the class number in subfield a that is taken from the Schedule before any numbers are added to it from the DDC Tables or from elsewhere in the Schedule.
f	The number of the DDC Table from which a number is added to the number in subfield e.
g	The number taken from the DDC Table identified in subfield f.
h	A class number all or part of which was added to the number in subfield e in order to form the number in subfield a.
i	The number or span of numbers beneath which (as part of special instructions) is given the number that is added to the number in subfield e in order to form the class number in subfield a.
j	The number listed at the location identified in subfield i, which is added to the number in subfield e to form the class number in subfield a.
2	The number of the edition of *DDC* from which the class number in subfield a was taken.

He provided two examples of encoded class numbers in 082 fields of bibliographic records for each of the three ways of synthesizing DDC numbers. One example of a class number built from the Schedules and Tables was a directory of entomologists in Columbus, Ohio, bearing the synthesized class number 595.7002577157. The encoded number is:

082 0 ‡a595.7002577157 ‡e595.7 ‡f1 ‡g0025 ‡f2 ‡g77157 ‡219.

The a subfield is the complete class number as it would appear on the book and on cataloging records. Subfield e (595.7) is that part of the class number that is taken from the DDC Schedule before any other numbers are added to it from the Schedules or Tables. Subfield e was the only part of the DDC class number that was used in the DDC Online Project. (In DOC, it was called the Schedules DDC class number and was described in section 4.4.3.2.) The first f subfield denotes the number of the DDC Table from which a number is added to the class number in the previously listed e subfield. In this example, Table 1 has been used and the g subfield following this first f subfield contains the number (0025) taken from Table 1. The second f subfield denotes the number of the DDC Table from which a number is added to the class number in the previously listed e and f subfields. Table 2 has been used and the g subfield following this second subfield contains the number (77157) taken from Table 2.

Using Wajenberg's coding scheme, this class number 595.7002577157 now has three identifiable and indexable access points, i.e., 595.7 from the DDC Schedules, 0025 from Table 1, and 77157 from Table 2, whereas it only had one identifiable and indexable access point--595.7 from the DDC Schedules--in this study. Terms from these three sources could be automatically added to the bibliographic record from the machine-readable DDC Schedules and Tables: (1) "595 Other invertebrates" and "595.7 Insecta (Insects)" and the class here note "Entomology. Pterygota"; (2) "-025 Directories of persons and organizations"; and (3) "-77157 Columbus." In the experimental online catalog, a bibliographic record with this synthesized class number would only have been enhanced with terms from the DDC Schedule under 595 and 595.7. With coding in the classification number field, additional terms from the Tables and Schedules can now be added to a bibliographic record because the sources of these terms have been identified in the coding. These terms certainly add more subject information about an item with this class number than is possible through the DDC Schedules to which we were limited in this study.

Wajenberg provided an example of numbers added to the base number from the Schedules in a bibliography on the psychology of divorced men bearing the class number 016.1556432. The encoded number is

082 0 ‡a016.1556432 ‡e016 ‡h155.6432 ‡219.

The a subfield is the complete class number as it would appear on the book or on cataloging records. Subfield e (016) is that part of the class number that is taken from the DDC Schedules before any other numbers are added to it from the Schedules or Tables. This e subfield was the only part of the class number that we used in the DDC Online Project. The h subfield (155.6432) identifies the part of the class number taken from the DDC Schedules and concatenated to the class number in the e subfield. With the coding scheme applied to the full class number 016.1556432, terms from two sources can automatically be added to the bibliographic record from the machine-readable DDC Schedules: (1) "016 Subject bibliographies and catalogs" and (2) "155.643 Divorced status" and "155.6432 Men."

The procedure for applying the coding scheme to portions of class numbers in e, f, g, and h subfields, i.e., numbers synthesized from the Schedules and Tables, is straightforward. Wajenberg's coding scheme can also be applied to built DDC class numbers that are constructed by special add notes and footnotes scattered throughout the Schedules. These add notes and footnotes contain blocks of numbers that can be added to designated numbers. Wajenberg's coding scheme employs the i subfield and a number or range of numbers beneath which are given the number or range of numbers that can be added to the class number in subfield e. This i subfield is always followed by the j subfield which bears the exact number that has been added to the class number in subfield e. Wajenberg provided the example of a commentary on the Babylonian Talmud with the class number 296.12507. The encoded number is

082 0 ‡a296.12507 ‡e296.125 ‡i296.123-296.127 ‡j07 ‡219.

The a subfield is the complete class number as it would appear on the book or on cataloging records. The e subfield (296.125) is that part of the class number that is taken from the Schedule before any other numbers are added from the DDC Tables or Schedules. The i subfield designates the range of Schedule class numbers bearing the special add note. The j subfield is the exact part of the class number added to the number in the e subfield. With the coding applied to the full class number 296.12507, terms from two places in the Schedules can be identified in this number: (1) "296.12 Talmudic literature" and "296.125 Babylonian Talmud" and (2) "07 Commentaries" and its accompanying general and including notes "Criticism and interpretation arranged in textual order" and "Including texts accompanied by commentaries."

Wajenberg's coding scheme needs to differentiate between synthesizing whole or part class numbers from the Schedules. For example, the h subfield is used whether a whole (see 016) or part (see 296.387) of a Schedules class number is added to the base number. The use of the h subfield to designate the whole class number is satisfactory. A different subfield should be used to designate the part of a class number from a different portion of the Schedules that can be added to the base number preceded by the Schedules class number or range beneath which (as part of special instructions) is given the part of the class number. For example, a book on the attitude of Judaism toward the family bears the number 296.387835. This number could be encoded as follows:

‡a296.387835 ‡e296.387 ‡m291.171-291.1878 ‡n835 ‡219.

when subfield m designates the number or range of numbers beneath which (as part of special instructions) is given the part of the Schedules class number that is added to the number in subfield e to form the class number in subfield a, and when subfield n designates the part of the Schedules class number that is added to the number in subfield e to form the class number in subfield a.

The coding scheme devised by Wajenberg needs to be carefully evaluated and revised to accommodate and differentiate among the different ways of adding to base numbers. The revised scheme must, at least, enable bibliographic records with synthesized numbers to be automatically enhanced with terms from the DDC when numbers are synthesized from (1) numbers in the DDC Tables, (2) whole or part numbers in the Schedules, and (3) numbers built by special instructions in the Schedules. Once the coding scheme has been applied to class numbers in fields of bibliographic records, the chief benefit is the enhancement of these records with the DDC. The terms added to the records are the terms in subject-rich fields of the DDC Schedules and Tables. For the four books whose class numbers were described in this section, we have listed below captions taken from the DDC Schedules in which the Schedule caption at the most specific level is separated from the Schedule caption at the second-most specific level by a colon. (In bibliographic records in DOC, these terms from the lowest and second-lowest level of the DDC were reversed and separated by a period.) The other terms listed in the four examples are terms from the Tables and Schedules added to the record through add notes and footnotes in the Schedules and Tables.

1. Directory of entomologists in Columbus, Ohio (595.7002577157): Insecta (Insects): Other invertebrates; Directories of persons and organizations; Columbus

2. Bibliography on the psychology of divorced men (016.1556432): Subject bibliographies and catalogs; Men: Divorced status

3. Commentary on the Babylonian Talmud (296.12507): Babylonian Talmud: Talmudic literature; Commentaries

4. Attitude of Judaism toward the family (296.387835): Moral theology: Moral and social theology; Relation of the sexes, marriage, family: Social problems

Another benefit of the coding scheme is that it separates the individual elements of class numbers. Elements of class numbers in subfields e and h and the DDC terms added to records from these subfields can be indexed in separate class number and subject indexes. For example, the directory of entomologists in Columbus, Ohio, now has three indexable class numbers, i.e., 595.7, -025, and -77157, and seven subject terms from the DDC Schedules and Tables, i.e., insecta, insects, invertebrates, directories, persons, organizations, and columbus. These class numbers and terms allow online searchers to retrieve items bearing class numbers or subject terms from the Schedules and Tables and to browse the Schedules or Tables when their user-entered class number or term matches numbers or terms in the Schedules or Tables.

In DOC, subject retrieval of items through the DDC was limited to the best match of the class number in the a subfield in libraries' bibliographic records (which was a class number enumerated in the DDC Schedules or the e subfield in Wajenberg's scheme). If Wajenberg's scheme is applied to class numbers in bibliographic records, searchers would have access to the individual class number elements of synthesized class numbers from the Schedules and Tables. Users would be able to retrieve items on the psychology of divorced men (with the class number 155.6432) and bibliographies on the psychology of divorced men (with the class number 016.1556432). Users could find all library materials on Ohio through the enhancement of records with the Table class number -771 or user-entered term "Ohio" and then limit the results by another topic of interest, e.g., "Savings and loan institutions" (Schedules class number 332.32), "College football" (Schedules class number 796.33263), "Vocational education" (Schedules class number 374.013). The next section explores the subject searching capabilities of an online catalog enhanced with the DDC in which Wajenberg's scheme has been applied to class numbers in bibliographic records.

9.5.2 Subject Searching in Online Catalogs Enhanced with the DDC

In online catalogs, the DDC can be a searcher's tool for subject access, browsing, and display. The addition of unique subject-rich terms from the DDC enhances subject access to the online catalog. The DDC provides new strategies for subject searching and browsing that are not possible through the alphabetical approaches of subject headings and/or keywords presently supported by online catalogs. The DDC also enhances the display of subject-rich information in bibliographic records and in displays of the bookshelf areas where retrieved items in online searches are located.

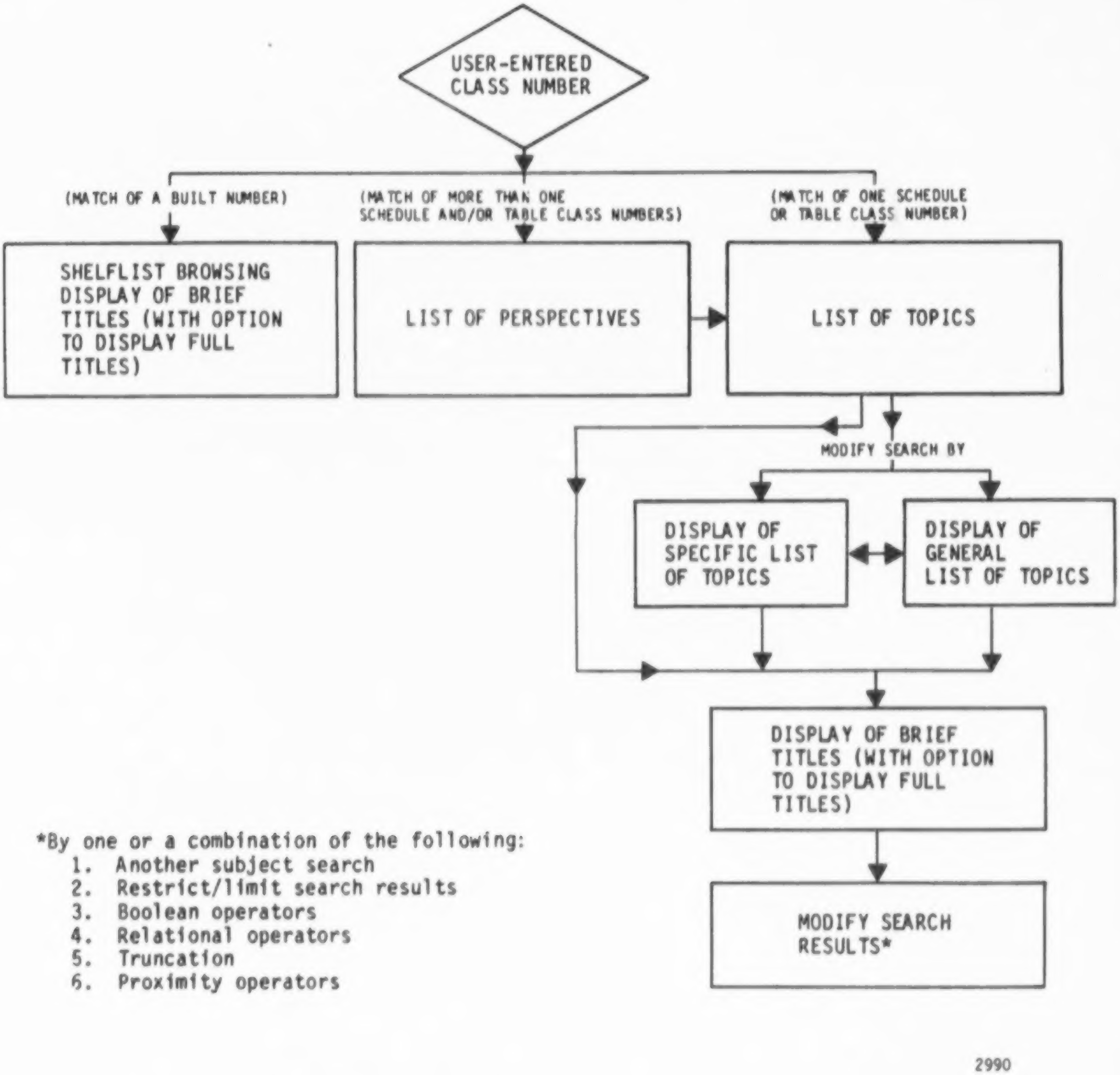
This section contains our recommendations for the enhancement of online catalogs' subject searching capabilities with the DDC based on our experiences searching the experimental online catalog and evaluating the results of online retrieval tests with library patrons and staff. Our recommendations are couched in terms of the experimental online catalog's capabilities. They describe how we would redesign this catalog in view of this study's results and without regard to cost or any particular computer's constraints. Our recommendations are not limited to the integration of the DDC into online catalogs' subject searching capabilities; they include the three major sources of subject-rich information about the library's collection: (1) bibliographic records, (2) library classification, and (3) the controlled vocabulary used by the library (which we have assumed is based on the *Library of Congress Subject Headings* (Subject Cataloging Division 1980)).

In our redesign of the experimental online catalog, the four approaches to subject searching, i.e., alphabetical, subject outline, class (call) number, and direct searching, are maintained. However, the end results of each of these approaches, except direct searching, are bibliographic records retrieved by the user-entered or user-selected term in subject searches and/or bookshelf areas where library materials on the user-entered or user-selected term are located.

The end result of subject searches in existing online catalogs is only the retrieval of bibliographic records. Online catalogs have not supported bookshelf browsing, but research in the use of traditional library catalogs and online catalogs suggests that the end result of library patrons' subject searches at the catalog is the retrieval of a relevant bibliographic record and the location of this record in the bookshelves. The patron may or may not find the actual item whose bibliographic record was retrieved in the catalog, but he is certainly bound to browse the bookshelf areas in the neighborhood of the retrieved record to find library material comparable to the subject matter of the retrieved bibliographic record (Markey 1984, 125; Gorman 1984; Willard and Teece 1983). The redesign of the experimental online catalog offers both end results of subject searches--bibliographic records and bookshelf areas where retrieved bibliographic records are located--through the integration of subject-rich information in bibliographic records, library classification, and the controlled vocabulary used by the library.

9.5.2.1 Class (or Call) Number Searching

Fig. 50 shows class (call) number searching in flowchart format in a redesigned experimental online catalog. In class number searching, the searcher usually enters a class number that he has previously identified as relevant through a previous subject search (see section 8.6). Menu options for class number searching in a redesigned experimental online catalog are shown in fig. 51.


USER-ENTERED CLASS NUMBER
(MATCH OF A BUILT NUMBER)
(MATCH OF MORE THAN ONE SCHEDULE AND/OR TABLE CLASS NUMBERS)
(MATCH OF ONE SCHEDULE OR TABLE CLASS NUMBER)
SHELFLIST BROWSING DISPLAY OF BRIEF TITLES (WITH OPTION TO DISPLAY FULL TITLES)
LIST OF PERSPECTIVES
LIST OF TOPICS
MODIFY SEARCH BY
DISPLAY OF SPECIFIC LIST OF TOPICS
DISPLAY OF GENERAL LIST OF TOPICS
DISPLAY OF BRIEF TITLES (WITH OPTION TO DISPLAY FULL TITLES)
MODIFY SEARCH RESULTS*
2990

*By one or a combination of the following:
1. Another subject search
2. Restrict/limit search results
3. Boolean operators
4. Relational operators
5. Truncation
6. Proximity operators

Fig. 50. Flowchart of class number searching in a redesigned experimental online catalog

```
Menu 1   -----------------------------------------------
        | SA (see fig. 57)                              |
        | SS (see fig. 69)                              |
        | SD (see fig. 65)                              |
        | SC Search for call number (1) ================|==>Menu 2
        | MR Modify results (2) ========================|==>fig. 53
        | RS Review searches (2) =======================|==>fig. 53
         -----------------------------------------------
Menu 2   -----------------------------------------------
        | [ List of Perspectives ]                      |
        | BP Browse a perspective ======================|==>Menu 3
        | SO Start over ================================|==>Menu 1
         -----------------------------------------------
Menu 3   -----------------------------------------------
        | [ List of Topics ]                            |
        | BG Browse more general topics                 |
        | BS Browse more specific topics                |
        | GN Get detailed notes for a listed topic      |
        | RP Return to perspectives list ===============|==>Menu 2
        | SL Select line(s) to display items ===========|==>Menu 5
        | SO Start over ================================|==>Menu 1
         -----------------------------------------------
Menu 4   -----------------------------------------------
        | [ List of Topics ]                            |
        | BG Browse more general topics                 |
        | BS Browse more specific topics                |
        | GN Get detailed notes for a list or topic     |
        | SL Select line(s) to display items ===========|==>Menu 5
        | SO Start over ================================|==>Menu 1
         -----------------------------------------------
Menu 5   -----------------------------------------------
        | [ Brief Titles List ]                         |
        | BF Browse forward in title list               |
        | BB Browse backward in title list              |
        | ST Select title for full information          |
        | RT Return to topics list =====================|==>Menu 3 or 4
        | RS Review searches ===========================|==>fig. 53
         -----------------------------------------------
 Menu 6  -----------------------------------------------
        | [ Shelflist Browsing Display ]                |
        | BF Browse forward in title list               |
        | BB Browse backward in title list              |
        | ST Select title for full information          |
        | SO Start over ================================|==>Menu 1
         -----------------------------------------------
```

(1) Menu 4 if user-entered class number matches one class number in DDC Tables or Schedules or Menu 6 if user-entered class number matches a synthesized class number.
(2) Shown if there is at least one set.

Fig. 51. Options for class number searching in a redesigned experimental online catalog

The searcher in our example has already identified the class number 332.673 as relevant to his topic of "Foreign investments in the United States" and enters this class number into the catalog. In class number searches in a redesigned experimental online catalog, the user-entered class number can be a number that corresponds to a number in the Schedules and/or Tables. If the user-entered class number matches more than one class number in the Schedules or Tables, the system responds with a List of Perspectives just like the List of Perspectives constructed in subject outline searches (sections 5.3.4 and 5.5.2.4). This list is an intermediate step to enable the searcher to first identify the general subject of his entered class number and then proceed to the specific List of Topics. In our example, the system is able to build a List of Topics around the user-entered class number "332.67" from the DDC Schedules. A List of Topics and options are provided in a redesigned class number search in the experimental online catalog in fig. 52. This is the same system response as DOC's response to the user-entered class number "332.67."

```
What would you like to do? > sc 332.67

>>>>> YOUR REQUEST...sc:332.67

* ITEMS ON YOUR SUBJECT ARE FOUND UNDER 332.67 IN THIS OUTLINE OF RELATED
  SUBJECTS.

GENERAL TOPIC : 332.6 Investment and investments
    LINE  ITEMS  AREA           TOPIC
       A     18  332.60         General aspects
       B     11  332.62         Brokerage firms
       C    159  332.63         Forms of investment
       D     42  332.64         Exchange of securities and commodities
       E      0  332.65         International exchange of securities
       F      2  332.66         Investment banks and banking
    *  G    134  332.67         Specific fields of investment
       H      0  332.68         Lotteries

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    SO  Start over
```

Fig. 52. CLass number searching for "332.67" in a redesigned experimental online catalog

The searcher selects line G and displays items such as *A guide to mineral investment in the Sudan*, *Two Canadian investment outlook surveys*, and *Office building rehabilitation*. Rather than display all 134 items, the user decides to modify the results by another subject search. Menu options for modifying search results are shown in fig. 53. In fig. 54, the four subject search options are presented to the searcher, and he selects the direct search to modify his ongoing search. When the system reports the set of items retrieved in the direct search, it includes the results of previous sets and options to "Find items common to 2 or more sets" (i.e., Boolean AND operation), "Include items from 2 or more sets" (i.e., Boolean OR operation), and "Exclude items from 2 or more sets" (i.e., Boolean NOT operation). The searcher selects the first operation to combine the results of sets 1 and 2 through a Boolean AND operation. The searcher retrieves 12 items through the logical combination of items beginning with the class number 332.67 <u>and</u> the keywords "United" and "States" in any of the subject-rich fields of the bibliographic record.

```
Menu 11  --------------------------------------------------------
        | SA  (see fig. 57)                                      |
        | SS  (see fig. 69)                                      |
        | SD  (see fig. 65)                                      |
        | SC  (see fig. 51)                                      |
        | MR  Modify results (1) ================================|==>Menu 12
        | RS  Review searches (1) ===============================|==>Menu 18
         --------------------------------------------------------

Menu 12  --------------------------------------------------------
        | MY  Modify results by year of publication =============|==>Menu 13
        | ML  Modify results by language ========================|==>Menu 14
        | MS  Modify results by another subject =================|==>Menu 15
        | MP  Modify previous results ===========================|==>Menu 16
         --------------------------------------------------------

Menu 13  --------------------------------------------------------
        | [ Summary of Searches ]                                |
        | (System-supplied prompts:)                             |
        |  Enter sets (separated by commas) to modify >          |
        |  Enter earliest year >                                 |
        |  Enter latest year >                                   |
        |  [ Intermediary Report of Created Set(s) ]             |
        |  DI Display items =====================================|==>Menu 17
        |  SO Start over ========================================|==>Menu 11
         --------------------------------------------------------

Menu 14  --------------------------------------------------------
        | [ Summary of Searches ]                                |
        | (System-supplied prompts:)                             |
        | Enter sets (separated by commas) to modify >           |
        | [ Menu of ten "commonly" requested languages (e.g.,    |
        |    English, French, German) ]                          |
        | Select language(s) of interest >                       |
        | [ Intermediary Report of Created Set(s) ]              |
        | DI Display items ======================================|==>Menu 17
        | SO Start over =========================================|==>Menu 11
         --------------------------------------------------------
```

(1) Shown if there is at least one set.

Fig. 53. Options for modifying search results in a redesigned experimental online catalog (cont. on next page)

```
Menu 15    -------------------------------------------------------
          | SA Search alphabetically for subject =================|==>fig. 57
          | SS Search subject outline for subject ================|==>fig. 69
          | SD Search directly for subject =======================|==>fig. 65
          | SC Search for call number ============================|==>fig. 51
          | (When user has created a set of items in a subject    |
          | search, catalog responds with Menu 16) ===============|==>Menu 16
           -------------------------------------------------------

Menu 16    -------------------------------------------------------
          | [ Summary of Searches ]                               |
          | FI Find items common to 2 or more sets ===============|==>Menu 17
          | II Include items from 2 or more sets =================|==>Menu 17
          | EI Exclude items from 2 or more sets =================|==>Menu 17
          | SO Start over ========================================|==>Menu 17
           -------------------------------------------------------

Menu 17    -------------------------------------------------------
          | [ Brief Titles List ]                                 |
          | BF Browse forward in title list                       |
          | BB Browse backward in title list                      |
          | ST Select title for full information                  |
          | RS Review searches ===================================|==>Menu 18
           -------------------------------------------------------

Menu 18    -------------------------------------------------------
          | [ Summary of Searches ]                               |
          | DI Display items =====================================|==>Menu 17
          | MR Modify results ====================================|==>Menu 12
          | SO Start over ========================================|==>Menu 11
           -------------------------------------------------------
```

Fig. 53. Options for modifying search results in a redesigned experimental online catalog (continued)

```
What would you like to see the next item? > n

•
•
•

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific items
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > so

>>>>>  YOUR REQUEST...so

OPTION DESCRIPTION
    SA  Search alphabetically for subject
    SS  Search subject outline for subject
    SD  Search directly for subject
    SC  Search for call number
    MR  Modify results
    RS  Review searches

What would you like to do? > mr

>>>>>  YOUR REQUEST...mr

OPTION  DESCRIPTION
    MY  Modify results by year of publication
    ML  Modify results by language
    MS  Modify results by another subject
    MP  Modify previous results

What would you like to do? > ms

>>>>> YOUR REQUEST...ms

OPTION  DESCRIPTION
    SA  Search alphabetically for subject
    SS  Search subject outline for subject
    SD  Search directly for subject
    SC  Search for call number
```

Fig. 54. Modifying results of a class number search for "332.67" by direct search for "United States" (cont. on next page)

```
What would you like to do? > sd
Enter subject to search > united states

>>>>> YOUR REQUEST....sd:united states
     2804 ITEMS FOR "united"
     2754 ITEMS FOR "states"
     2694 ITEMS IN SET 2  (united states)

   THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
   SET  ITEMS    REQUEST
     1    134    sc:332.67 Specific fields of investment
     2   2694    sd:united states

OPTION  DESCRIPTION
    FI  Find items common to 2 or more sets
    II  Include items from 2 or more sets
    EI  Exclude items from 2 or more sets
    SO  Start over

What would you like to do? > fi
Enter set numbers (separated by commas) > 1,2

>>>>> YOUR REQUEST...fi 1 and 2
         12 ITEMS IN SET 3  (1 AND 2)

FULL CALL NUMBER, BRIEF TITLE, AND YEAR OF ITEMS 1-10 ARE:

LINE  CALL NUMBER/TITLE/YEAR
   A  332.671256/ Investing in the future/ 1982
   B  332.6720973 I48/ Investing in America/ 1982
   C  332.6730973 B25/ Foreign manufacturing investment in the U.S./ 1983
   D  332.6730973 D57/ Direct investment in the United States by foreign gove/ 1983
   E  332.6730973 F6/ Foreign investment in the United States/ 1983
   F  332.678 C34/ Strategic investing/ 1982
   G  332.678 M32/ Investing for profit in the eighties/ 1982
   H  332.678 P3/ How to strike it rich in the coming boom/ 1983
   I  332.678 R55/ Gaining on the market/ 1982
   J  332.678 S55/ How to profit from disinflation/ 1982

OPTION  DESCRIPTION
    BF  Browse forward in title list
    BB  Browse backward in title list
    ST  Select title for full information
    RS  Review searches
```

Fig. 54. Modifying results of a class number search for "332.67" by direct search for "United States" (continued)

The searcher involved in this search for "Foreign investments in the United States" feels that the retrieved items bearing the synthesized class number 332.6730973 are particularly relevant to his expressed topic and enters this synthesized class number into the experimental online catalog. This time the catalog cannot respond with a List of Topics because there is no caption or class number in the DDC Schedules or Tables for the number 332.6730973. Thus, the system responds with a shelflist browsing display of brief titles in fig. 55.

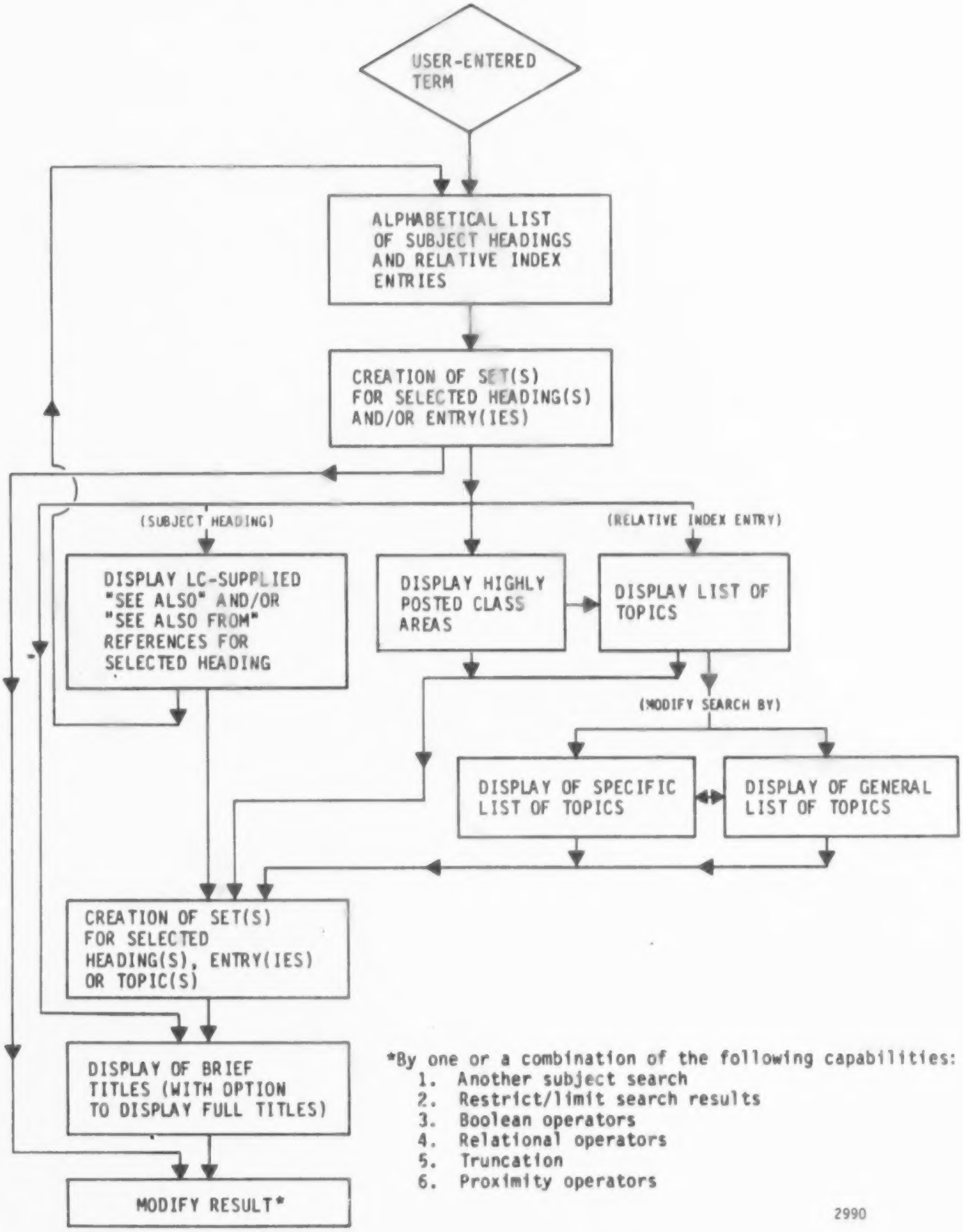
```
What would you like to do? > sc
Enter call number > 332.6730973

>>>>> YOUR REQUEST...sc:332.6730973

FULL CALL NUMBER, BRIEF TITLE, AND YEARS OF ITEMS ON THE BOOKSHELF NEARBY
"332.6730973" ARE:

LINE  CALL NUMBER/TITLE/DATE
   A  332.6730968 B55/ Financial aspects of economic sanctions on South Africa/ 1981
   B  332.673096891 C557/ Foreign companies and international investment in Zi/ 1980
   C  332.6730973 B25/ Foreign manufacturing investment in the U.S./ 1983
   D  332.6730973 D57/ Direct investment in the United States by foreign gover/ 1983
   E  332.6730973 F6/ Foreign investment in the United States/ 1983
   F  332.6730994 I58/ Investments in Argentina/ 1981
   G  332.67309969 S24/ A listing of foreign investments in Hawaii/ 1981
   H  332.678 C34/ Strategic investing/ 1982
   I  332.678 C66/ Make money on the interest rate roller coaster/ 1982
   J  332.678 D82/ The duck book/ 1982

OPTION  DESCRIPTION
    BF  Browse forward in title list
    BB  Browse backward in title list
    ST  Select title for full information
    RS  Review searches
```

Fig. 55. Shelflist browsing display for the user-entered built class number "332.6730973"

The options following the shelflist browsing display allow the searcher to browse forward and backward (BF or BB) in the display to scan titles shelved after the last title or before the first title in the list and to display full bibliographic information (ST). Repeatedly entering the BB or BF options, the searcher can browse the entire shelflist of the library from 001 to 999. Since the result of the selection of titles from the shelflist browsing display is individual titles, no modification of the result is necessary. However, limiting the shelflist by year of publication, language, or branch library may be a desired capability in certain online catalogs.

9.5.2.2 Alphabetical Searching

Fig. 56 shows alphabetical searching in flowchart format in a redesigned experimental online catalog. Menu options for alphabetical searching are shown in fig. 57. The system response to the user-entered term is a combined alphabetical list of all subject headings in bibliographic records and Relative Index entries. The searcher can browse and select headings and entries in the alphabetical neighborhood of his entered term. Once the searcher selects a listed subject heading or entry, the searcher has three display options: (1) display retrieved bibliographic records (DI); (2) display highly posted class areas where items on the user-selected heading or entry are located (DL); or (3) display a related subject heading(s) or class area(s) for the user-selected heading or entry (DR). For example, the user-entered term "boundary value problems" produces an alphabetical list of subject headings, Relative Index entries, and postings (fig. 58).


USER-ENTERED TERM
ALPHABETICAL LIST OF SUBJECT HEADINGS AND RELATIVE INDEX ENTRIES
CREATION OF SET(S) FOR SELECTED HEADING(S) AND/OR ENTRY(IES)
(SUBJECT HEADING)
(RELATIVE INDEX ENTRY)
DISPLAY LC-SUPPLIED "SEE ALSO" AND/OR "SEE ALSO FROM" REFERENCES FOR SELECTED HEADING
DISPLAY HIGHLY POSTED CLASS AREAS
DISPLAY LIST OF TOPICS
(MODIFY SEARCH BY)
DISPLAY OF SPECIFIC LIST OF TOPICS
DISPLAY OF GENERAL LIST OF TOPICS
CREATION OF SET(S) FOR SELECTED HEADING(S), ENTRY(IES) OR TOPIC(S)
DISPLAY OF BRIEF TITLES (WITH OPTION TO DISPLAY FULL TITLES)
MODIFY RESULT*
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*By one or a combination of the following capabilities:
1. Another subject search
2. Restrict/limit search results
3. Boolean operators
4. Relational operators
5. Truncation
6. Proximity operators

Fig. 56. Flowchart of alphabetical searching in a redesigned experimental online catalog

```
Menu 21   --------------------------------------------------------
         | SA  Search alphabetically for subject =================|==>Menu 22
         | SS  (see fig. 69)                                      |
         | SD  (see fig. 65)                                      |
         | SC  (see fig. 51)                                      |
         | MR  Modify results (1) ================================|==>fig. 53
         | RS  Review  searches (1) ==============================|==>fig. 53
          --------------------------------------------------------

Menu 22   --------------------------------------------------------
         | [ List of Subjects (i.e., subject headings and         |
         |    DDCRI entries) ]                                    |
         | BF  Browse forward in alphabetical list                |
         | BB  Browse backward in alphabetical list               |
         | SL  Select line(s) to display items ===================|==>Menu 23
         | SO  Start over ========================================|==>Menu 21
          --------------------------------------------------------

Menu 23   --------------------------------------------------------
         | [ Intermediary Report of Created Set(s) ]              |
         | DI  Display items =====================================|==>Menu 24
         | DL  Display location(s) of items ======================|==>Menu 25
         | DR  Display related subjects (2) ======================|==>Menu 26
         | RA  Return to alphabetical subjects list ==============|==>Menu 22
         | SO  Start over ========================================|==>Menu 21
          --------------------------------------------------------

Menu 24   --------------------------------------------------------
         | [ Brief Titles List ]                                  |
         | BF  Browse forward in title list                       |
         | BB  Browse backward in title list                      |
         | ST  Select title for full information                  |
         | RL  Return to last list consulted =====================|==>Menu 23,
         |                                                        |   25, 26,
         |                                                        |   27, 28,
         |                                                        |   or 29
         | RS  Review searches ===================================|==>Menu 21
          --------------------------------------------------------

Menu 25   --------------------------------------------------------
         | [ Bookshelf Locations List ]                           |
         | SL  Select line(s) to display items ===================|==>Menu 24
         | SB  Select line to browse a listed bookshelf
         |         location (3) ==================================|==>Menu 29
         | RL  Return to last list consulted =====================|==>Menu 23
         | SO  Start over ========================================|==>Menu 21
          --------------------------------------------------------
```

(1) Shown if there is at least one set
(2) Menu 28 if user-selected term is a Relative Index entry
(3) Menu 30 if user-selected bookshelf browsing location is a synthesized class number

Fig. 57. Options for alphabetical searching in a redesigned experimental online catalog (cont. on next page)

```
Menu 26     ------------------------------------------------------
           | [ Related and More Specific Subjects List (i.e., "see|
           | also" references with default to display of "see also|
           | from" references if the former are not available for |
           | this heading) ]                                      |
           | SL  Select line(s) to display items =================|==>Menu 24
           | BG  Browse related and more general subjects for     |
           |     "user-selected subject heading" =================|==>Menu 27
           | SA  Search alphabetically for a listed related       |
           |     subject =========================================|==>Menu 22
           | RL  Return to last list consulted ===================|==>Menu 23
           | SO  Start over ======================================|==>Menu 21
            ------------------------------------------------------

Menu 27     ------------------------------------------------------
           | [ Related and More General Subjects List (i.e., "see |
           | also from" references) ]                             |
           | SL  Select line(s) to display items =================|==>Menu 24
           | SA  Search alphabetically for a listed subject ======|==>Menu 22
           | RL  Return to last list consulted ===================|==>Menu 23 or 26
           | SO  Start over ======================================|==>Menu 21
            ------------------------------------------------------

Menu 28     ------------------------------------------------------
           | [ List of Topics ]                                   |
           | BG  Browse more general topics                       |
           | BS  Browse more specific topics                      |
           | GN  Get detailed notes for a listed topic            |
           | SL  Select line(s) to display items  ================|==>Menu 24
           | RL  Return to last list consulted  ==================|==>Menu 23
           | SO  Start over  =====================================|==>Menu 21
            ------------------------------------------------------

Menu 29     -----------------------------------------------------
           | [ List of Topics ]                                  |
           | BG  Browse more general topics                      |
           | BS  Browse more specific topics                     |
           | GN  Get detailed notes for a listed topic           |
           | SL  Select line(s) to display items  ===============|==>Menu 24
           | RB  Return to bookshelf locations list  ============|==>Menu 25
           | SO  Start over  ====================================|==>Menu 21
            -----------------------------------------------------

Menu 30     -----------------------------------------------------
           | [ Shelflist Browsing Display ]                      |
           | BF  Browse forward in title list                    |
           | BB  Browse backward in title list                   |
           | ST  Select title for full information               |
           | RB  Return to bookshelf locations list  ============|==>Menu 25
           | SO  Start over  ====================================|==>Menu 21
            -----------------------------------------------------
```

Fig. 57. Options for alphabetical searching in a redesigned experimental online catalog (continued)

```
What would you like to do? > sa
Enter subject to search > boundary value problems

>>>>> YOUR REQUEST...sa:boundary value problems

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
LINE  ITEMS  ALPHABETICAL SUBJECTS
   A     26  Boolean algebra
   B      1  Borel, Emile Felix Edouard Justin, 1871-
*  C     29  Boundary value problems
   D      1  Boundary value problems--Addresses, essays, lectures
   E      8  Boundary value problems: Calculus of finite differences
   F      3  Boundary value problems--Congresses
   G    101  Boundary value problems: Differential equations
   H      6  Boundary value problems--Numerical solutions
   I      1  Boundary value problems--Numerical solutions--Congresses
   J      1  Boundary value problems--Periodicals

OPTION  DESCRIPTION
    BF  Browse forward in alphabetical list
    BB  Browse backward in alphabetical list
    SL  Select line(s) to display items
    SO  Start over

What would you like to do?  >  sl
Enter lines (separated by commas) or ALL to select > c,e

>>>>> YOUR REQUEST...sl c,e
      29 ITEMS IN SET 1 (Boundary value problems)
       8 ITEMS IN SET 2 (Boundary value problems: Calculus of finite differences)

OPTION  DESCRIPTION
    DI  Display items
    DL  Display location(s) of items
    DR  Display related subjects
    RA  Return to alphabetical subjects list
    SO  Start over
```

Fig. 58. Alphabetical searching for "Boundary value problems" in a redesigned experimental online catalog

In this alphabetical display, subdivisions of subject headings are concatenated to other subdivisions and main terms by hyphens; secondary Relative Index entries are concatenated to other secondary entries and main entries by colons. As suggested in section 8.5.2, the system should ignore punctuation and hyphenation when matching the user-entered term to indexed controlled vocabulary terms in alphabetical searches. Once this alphabetical display has been presented to the searcher, he has the options of browsing forward or backward in the display or selecting one or more listed headings and/or entries. We recommend the integration of subject headings and Relative Index entries into a single alphabetical display to take advantage of the specificity provided by subject headings with subdivisions and the ability of Relative Index entries to direct searchers to a single bookshelf area for a general topic. Relative Index entries do not provide the specificity of subject headings as demonstrated in sections 8.5.3 and 8.5.5, especially in subject searches for specific names of people, names of corporate bodies, and named objects and structures, combinations of topical and geographic headings into a single subject heading, and two or more topics expressed in one subject heading.

The searcher can select one or more listed headings and/or entries from the alphabetical display. Separate sets of bibliographic records are created by the searcher's selection of more than one heading and/or entry. For example, the searcher's selection of lines C and E in the alphabetical display in fig. 58 results in a set of 29 items for the subject heading "Boundary value problems" and a separate set of eight items for the Relative Index entry "Boundary value problems: Calculus of finite differences."

The reason for creating separate sets is that the manipulation of the 29 items in set 1 and eight items in set 2 are different because a subject heading was selected in set 1 and a Relative Index entry was selected in set 2. In alphabetical searches, Relative Index entries, subject headings in bibliographic records with LC-supplied "see also" and/or "see also from" references, and subject headings in bibliographic records without such references can be selected. Three display options allow searchers to continue the search through displays of retrieved items, class number areas, and related terms. For example, the searcher can display the 29 or eight retrieved items in sets 1 or 2 (DI), display the class number areas where items on the user-selected subject heading or Relative Index entry are classed (DL), or, in the case of a user-selected LC subject heading, display the LC-supplied "see also" and/or "see also from" references (DR) (i.e., when such references are provided in LC-distributed subject authority records) or in the case of a user-selected Relative Index entry, display a List of Topics (i.e., DDC Schedule captions) built around the class number of the Relative Index entry (DR). Let's say that the searcher involved in the "Boundary value problems" search chooses the DL option (display location[s] of items) for the subject heading in set 1. The system responds to him with a list of class numbers where most of the items are classed when "Boundary value problems" is the first-listed subject heading in the bibliographic record (fig. 59). Of the 29 items assigned "Boundary value problems," most are found under 515.35. The three areas where items are found on "Boundary value problems" are not synthesized numbers; thus, their DDC Schedule captions can be displayed alongside listed class numbers.

```
What would you like to do? > dl
Enter a set number to display > 1

>>>>> YOUR REQUEST...dl 1

ITEMS ON "Boundary value problems" ARE FOUND AT THESE BOOKSHELF LOCATIONS:

LINE  ITEMS  BOOKSHELF LOCATIONS/TOPIC
   A     10  515.35 Differential equations:  Differential calculus and
             equations
   B      3  515.62 Calculus of finite differences:  Other analytic methods
   C      2  515.43 Integral calculus:  Integral calculus and equations

OPTION  DESCRIPTION
    SL  Select line(s) to display items
    SB  Select line to browse a listed bookshelf location
    RL  Return to last list consulted
    SO  Start over
```

Fig. 59. Bookshelf Locations List for a user-selected subject heading in an alphabetical search

At this point, the searcher can select one or more lines to display retrieved items in shelflist order (SL) or select one line to obtain a List of Topics constructed around the listed Schedule class number (SB). If the user selects a synthesized class number, the system displays a shelflist review of brief titles for the user-selected synthesized class number (Menu 30, fig. 57). In this example, the searcher selects line B and the system constructs a List of Topics around 515.62 (fig. 60).

```
What would you like to do? > sb
Enter line to select > b

* ITEMS ON YOUR SUBJECT ARE FOUND UNDER 515.62 IN THIS OUTLINE OF RELATED
  TOPICS.

GENERAL TOPIC : 515.6 Other analytic methods.
    LINE  ITEMS  LOCATION          TOPIC
    *  A     18  515.62            Calculus of finite differences.
       B     17  515.63            Vector, tensor, spinor analysis.
       C     15  515.64            Calculus of variations.

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    RB  Return to bookshelf locations list
    SO  Start over
```

Fig. 60. List of Topics resulting from a user-selected bookshelf location

The searcher can now select a listed topic to display bibliographic records (SL), browse more specific or general topics (BS or BG), or select a listed topic to retrieve subject-rich Schedule notes and Relative Index entries associated with it (GN). This is the same display that results from a subject outline search in DOC (section 5.3.4). In subject outline searches, the user retrieves this display after matching his term with the words in Schedule captions and notes, Relative Index entries, and first-listed subject headings in bibliographic records. In alphabetical searching in a redesigned experimental online catalog, the user retrieves this display through the selection of a subject heading.

The searcher can also select a Relative Index entry from the alphabetical display of headings and entries in fig. 58 and manipulate it in ways similar to subject headings. For example, set 2 in this search for "Boundary value problems" was a set of eight items retrieved by the Relative Index entry "Boundary value problems: Calculus of finite differences" as shown in fig. 61 where the user backs up to the menu of display options.

```
What would you like to do? > rb
   •
   •
   •
OPTION  DESCRIPTION
    SL  Select line(s) to display items
    SB  Select line to browse a listed bookshelf location
    RL  Return to last list consulted
    SO  Start over

What would you like to do? > rl

>>>>> YOUR REQUEST...rl
        29 ITEMS IN SET 1 (Boundary value problems)
         8 ITEMS IN SET 2 (Boundary value problems: Calculus of finite differences)

OPTION  DESCRIPTION
    DI  Display items
    DL  Display location(s) of items
    DR  Display related subjects
    MO  Modify results
```

Fig. 61. Return to a menu of display options in alphabetic searching for "Boundary value problems"

The searcher has the same options as he had when selecting the subject heading. If the searcher selects the DR option, he immediately obtains a List of Topics constructed around class number (515.62) of the selected entry "Boundary value problems: Calculus of finite differences." This time he decides to select the DL option along with the results of set 2 for the Relative Index entry (fig. 62).

```
What would you like to do? > dl
Enter a set number to display > 2

>>>>> YOUR REQUEST...dl 2

* ITEMS ON "Boundary value problems: Calculus of finite differences" ARE FOUND
  AT THIS BOOKSHELF LOCATION:

LINE  ITEMS  BOOKSHELF LOCATION/TOPIC
*  A     18  515.62 Differential equations: Calculus of finite differences

OPTION  DESCRIPTION
    SL  Select line(s) to display items
    SB  Select line to browse bookshelf location or topics
    RL  Return to last list consulted
    SO  Start over
```

Fig. 62. Bookshelf Location List for a user-selected Relative Index entry in an alphabetical search

If the searcher selects the first option (SL), he obtains a brief title display of the 18 retrieved items. Selecting the second option (SB), he obtains a List of Topics constructed around the listed Schedules class number 515.62 (SB). Class numbers retrieved by the selection of a Relative Index entry are usually taken from the Schedules or Tables, but some are built numbers. If the listed class number had been synthesized, the system would instead display a shelflist review of brief titles for the user-selected synthesized class number (fig. 57, Menu 30).

Some subject headings in the initial alphabetical display in fig. 58 are associated with LC-supplied "see also" and "see also from" references. In this search for "Boundary value problems," the user-selected subject heading "Boundary value problems" in set 1 has both types of references. After reviewing the alphabetical display, the searcher decides to display related subjects. The system first displays subject headings that are "see also" references in LC-supplied subject authority records and are posted in the online catalog's database. The option to display "see also from" references follows the display of "see also" references. "See also" references are displayed first, because these references are often more specific than the user-selected subject heading (Petersen 1983). Furthermore, patrons have a tendency to enter a broader representation of their expressed topic into the catalog and require online aids such as "see also" references to narrow their topic (see table 38). Unfortunately, "see also" references are not always subject headings that are more specific than the heading with which they are associated nor are "see also from" references always subject headings that are more general than the heading to which they are associated. Thus, we have used the term "related and more specific subjects" to designate "see also" references and "related and more general subjects" to designate "see also from" references in the display of such references in fig. 63.

```
What would you like to do? > rl

>>>>> YOUR REQUEST...rl
        29 ITEMS IN SET 1 (Boundary value problems)
         8 ITEMS IN SET 2 (Boundary value problems: Calculus of finite differences)

OPTION  DESCRIPTION
    DI  Display item(s)
    DL  Display location(s) of items
    DR  Display related subjects
    RA  Return to alphabetical subjects list
    SO  Start over

What would you like to do? > dr
Enter a set to display > 1

>>>>> YOUR REQUEST...dr 1

5 SUBJECTS ARE RELATED TO "Boundary value problems:"

GENERAL TOPIC : Boundary value problems
    LINE  ITEMS  RELATED AND MORE SPECIFIC SUBJECTS
       A      1  Dirichlet problem
       B      1  Eigenvalue problems
       C      4  Initial value problems
       D      3  Neumann problem
       E      3  Scattering (Mathematics)

OPTION  DESCRIPTION
    SL  Select line(s) to display items
    BG  Browse related and more general subjects for "Boundary value problems"
    SA  Search alphabetically for a listed related subject
    RL  Return to last list consulted
    SO  Start over
```

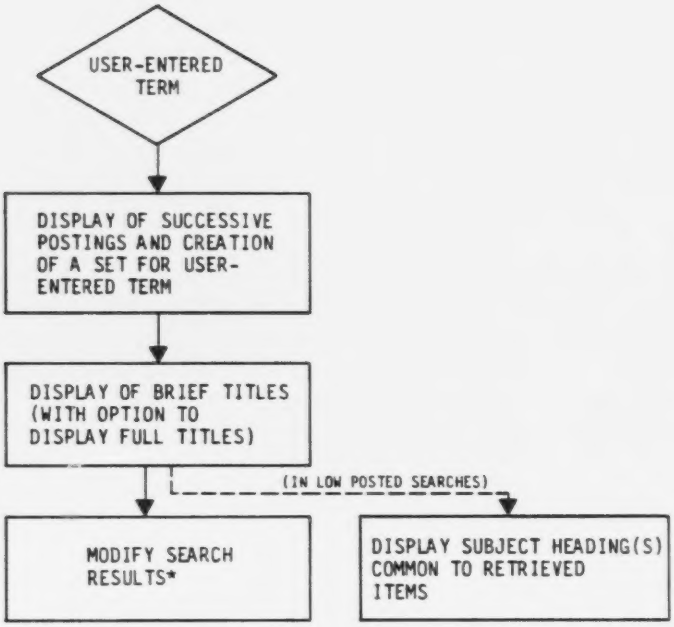
Fig. 63. Related subjects list in an alphabetical search

The options following the "see also" references allow the searcher to select one or more listed related subjects to retrieve bibliographic records (SL), browse "see also from" references for the subject heading "Boundary value problems" (BG), or select a listed related subject heading for which the system will produce the results of an alphabetical search (SA). The benefit of the SA option is that it saves the searcher from remembering a listed related subject heading and retyping it into the online catalog. When the searcher selects the SA option and a listed related subject heading, the system responds with an alphabetical display of subject headings that contains the selected related subject heading and its postings. This alphabetical display also contains the selected heading with subdivisions concatenated to the main heading. These main headings with subdivision(s) are composed by the library's subject cataloger or distributed in LC-supplied subject authority records. The LC-distributed main headings with subdivisions may be associated with "see also" and "see also from" references, but the library-composed main headings with subdivision(s) may not be associated with such references. The idea of mixing these library-composed and LC-distributed main headings with subdivision(s) is to stimulate subject searchers with a single list of alphabetical terms instead of separating LC-distributed and library-composed subject headings into two different lists. Thus, the searcher who selects the SA option following the list of related subjects obtains a new list of subject headings and Relative Index entries as the process of alphabetical searching shown in fig. 56 is repeated for this new term.

The process of alphabetical searching shown in fig. 56 allows the searcher to obtain a list of subject headings and Relative Index entries in the alphabetical neighborhood of the user-entered term. The searcher can browse and select listed heading(s) to (1) display retrieved bibliographic records; (2) display highly posted class areas where items on the user-selected heading or entry are located; and/or (3) find a related subject heading or class area that better expresses the searcher's topic of interest than the user-entered or user-selected term. After the creation of sets and display of retrieved items or class areas or related terms in alphabetical searches, the searcher should be reminded by an option or suggestive prompt that the results can be modified through the selection of the same or a different subject search and combination of these results with the previous search results or limiting the results of the ongoing search by year of publication or language. An example was given in fig. 54 (section 9.5.2.1) of modifying the results of a class number search. Menu options for modifying search results were presented in fig. 53.

9.5.2.3 Direct Searching

The direct search remains mostly unchanged from its original implementation in DOC (see section 5.3.2). Direct searches are a linear procedure as shown in fig. 64. The user-entered term is matched with the subject-rich fields of the bibliographic record including fields enhanced by the DDC. The intermediate results of the number of items retrieved by the individual words in the user-entered term precede the report of the final result, which is the logical combination of the words in the user-entered term through the Boolean AND operation. When the final result is presented, the searcher has the option to display retrieved items or modify the result. Menu options for direct searching in a redesigned experimental online catalog are presented in fig. 65.


USER-ENTERED TERM
DISPLAY OF SUCCESSIVE POSTINGS AND CREATION OF A SET FOR USER-ENTERED TERM
DISPLAY OF BRIEF TITLES (WITH OPTION TO DISPLAY FULL TITLES)
(IN LOW POSTED SEARCHES)
MODIFY SEARCH RESULTS*
DISPLAY SUBJECT HEADING(S) COMMON TO RETRIEVED ITEMS

*By one or a combination of the following:

1. Another subject search
2. Restrict/limit search results
3. Boolean operators
4. Relational operators
5. Truncation
6. Proximity operators

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Fig. 64. Flowchart of direct searching in a redesigned experimental online catalog

```
Menu 31   -------------------------------------------------------
          | SA  (see fig. 57)                                     |
          | SS  (see fig. 69)                                     |
          | SD  Search directly for subject =====================|==>Menu 32
          | SC  (see fig. 51)                                     |
          | MR  Modify results (1) ==============================|==>fig. 53
          | RS  Review searches (1) =============================|==>fig. 53
          -------------------------------------------------------

Menu 32   -------------------------------------------------------
          | [ Summary of Searches ]                               |
          | SA  Search alphabetically for "subject heading common |
          |     to retrieved items" (2) =========================|==>fig. 57
          | DI  Display items ===================================|==>Menu 33
          | SO  Start over ======================================|==>Menu 31
          -------------------------------------------------------

Menu 33   -------------------------------------------------------
          | [ Brief Titles List ]                                 |
          | BF  Browse forward in title list                      |
          | BB  Browse backward in title list                     |
          | ST  Select title for full information                 |
          | RS  Review searches =================================|==>Menu 31
          -------------------------------------------------------
```

(1) Shown if there is at least one set
(2) Shown after display of retrieved items is completed or terminated by the searcher

Fig. 65. Options for direct searching in a redesigned experimental online catalog

In the search for "Computers as an aid to mathematical statistics," the searcher first enters the term "mathematical statistics" and retrieves 170 items. After displaying items with titles, such as Studies in statistics, Identification and informative sample size, and Stanford studies in mathematics and statistics, the searcher decides to limit the results (fig. 66).

```
What would you like to do? > sd
Enter subject to search > mathematical statistics

>>>>> YOUR REQUEST...sd:mathematical statistics
     1221 ITEMS FOR "mathematical"
      274 ITEMS FOR "statistics"
      170 ITEMS IN SET 1 (mathematical statistics)

   THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
   SET  ITEMS    REQUEST
     1    170    sd:mathematical statistics

OPTION  DESCRIPTION
    DI  Display items
    SO  Start over
```

Fig. 66. Direct search for "Computers as an aid to mathematical statistics" in a redesigned experimental online catalog

The searcher modifies the results of the previous direct search in fig. 66 by entering another search for the term "data processing" and combining it in a Boolean AND operation. The search modification is shown in fig. 67 in which the user performs another direct search for "data processing," displays a few titles, and then enters the option to modify the results of previous searches. The user selects the option to "Find items common to 2 or more sets" (FI) and combines the results of sets 1 and 2 in a Boolean AND operation.

```
What would you like to do? > so

>>>>> YOUR REQUEST...so

OPTION  DESCRIPTION
    SA  Search alphabetically for subject
    SS  Search subject outline for subject
    SD  Search directly for subject
    SC  Search for call number
    RS  Review your searches
    ES  End search


What would you like to do? > sd
Enter subject to search > data processing

>>>>> YOUR REQUEST...sd:data processing
      225 ITEMS FOR "data"
       47 ITEMS FOR "processing"
       47 ITEMS IN SET 2 (data processing)

   THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
   SET  ITEMS    REQUEST
     1    170    sd:mathematical statistics
     2     47    sd:data processing

OPTION  DESCRIPTION
    DI  Display items
    SO  Start over


What would you like to do? > so

>>>>> YOUR REQUEST...so

OPTION DESCRIPTION
    SA  Search alphabetically for subject
    SS  Search subject outline for subject
    SD  Search directly for subject
    SC  Search for call number
    MR  Modify results
    RS  Review searches


What would you like to do? > mr

>>>>> YOUR REQUEST...mr
```

Fig. 67. Modifying the results of a direct search for "mathematical statistics" by a direct search for "data processing" (cont. on next page)

```
OPTION  DESCRIPTION
    MY  Modify results by year of publication
    ML  Modify results by language
    MS  Modify results by another subject
    MP  Modify previous results


What would you like to do? > mp

>>>>> YOUR REQUEST...mp

   THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
   SET  ITEMS    REQUEST
     1    170    sd:mathematical statistics
     2     47    sd:data processing

OPTION  DESCRIPTION
    FI  Find items common to 2 or more sets
    II  Include items from 2 or more sets
    EI  Exclude items from 2 or more sets
    SO  Start over


What would you like to do? > fi
Enter sets (separated by commas) > 1,2

>>>>> YOUR REQUEST...fi 1 and 2
        10 ITEMS IN SET 3 (1 AND 2)
```

Fig. 67. Modifying the results of a direct search for "mathematical statistics" by a direct search for "data processing" (continued)

Three of the ten items in set 3 bear the titles COMPSTAT: proceedings in computational statistics, Computational statistics and data analysis, and Basic statistical computing and are probably relevant to the user's expressed topic.

Direct searches which retrieve few items could be enhanced to automatically analyze the subject headings in retrieved items, find the headings common to the majority of the retrieved items, and suggest these to the searcher for entry in subsequent searches. Table 56 (section 8.3.5) listed five direct searches that retrieved 30 or fewer items. Had the searcher entered the subject heading common to the majority of retrieved items, additional relevant items would have been retrieved. For example, the searcher looking for items on "new netherlands" obtains the following prompt when completing the display of items:

```
Would you like to see the next item? > n

* The subject heading "New York (State)--History--Colonial period, ca.
  1600-1775" is listed in some of the items.  Choose the SA option to browse
  an alphabetical list with this subject and others like it.

THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
SET  ITEMS    REQUEST
  1     15    sd:new netherlands

OPTION  DESCRIPTION
*   SA  Search alphabetically for "New York (State)--History--Colonial...
    DI  Display items
    SO  Start over
```

Direct searches provide much less feedback than alphabetical and subject outline searches about the controlled vocabulary assigned to bibliographic records. The system's analysis of subject headings common to retrieved items is one way in which the online catalog can assist searchers, whose direct searches retrieve few items, to find additional library material.

9.5.2.4 Subject Outline Searching

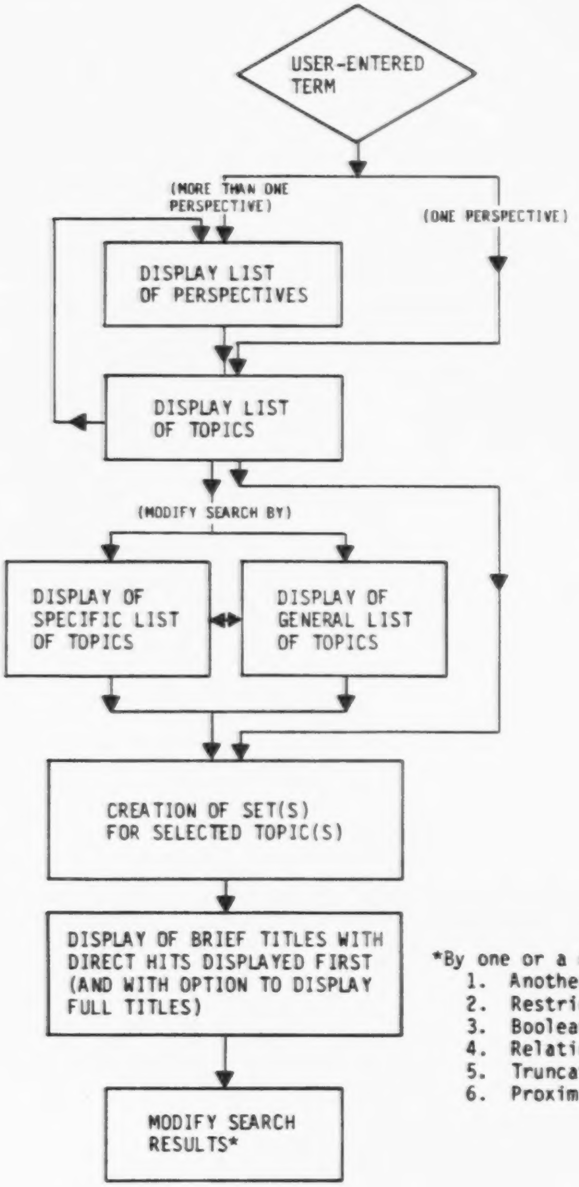
The failure analysis of subject outline searches (section 8.4) demonstrated drawbacks of this subject searching capability in the experimental online catalog. Suggested improvements to the subject outline search to provide better subject searching performance are the following:

- Change the grouping procedure so that DOC directs users to the class number and caption with the highest number of postings (during the grouping procedure described in section 5.5.2.4 [6.a]).

- Provide a limit by keyword, date, language, or other criteria as an option when the results of a subject outline search are displayed.

- Enhance the display of retrieved items so that the first items displayed in subject outline searches are those that would be retrieved in a direct search for the user-entered term and bear the class number of the outline.

These improvements are suggested for online catalogs when the index of the subject outline search contains words from Schedule captions and notes, Relative Index entries, and first-listed subject headings in bibliographic records. These improvements do not change the overall subject outline searching procedure very much (fig. 68).


USER-ENTERED TERM
(MORE THAN ONE PERSPECTIVE)
(ONE PERSPECTIVE)
DISPLAY LIST OF PERSPECTIVES
DISPLAY LIST OF TOPICS
(MODIFY SEARCH BY)
DISPLAY OF SPECIFIC LIST OF TOPICS
DISPLAY OF GENERAL LIST OF TOPICS
CREATION OF SET(S) FOR SELECTED TOPIC(S)
DISPLAY OF BRIEF TITLES WITH DIRECT HITS DISPLAYED FIRST (AND WITH OPTION TO DISPLAY FULL TITLES)
MODIFY SEARCH RESULTS*

*By one or a combination of the following:

1. Another subject search
2. Restrict/limit search results
3. Boolean operators
4. Relational operators
5. Truncation
6. Proximity operators

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Fig. 68. Flowchart of subject outline searching in a redesigned experimental online catalog

Options for modifying search results have been added to the procedures (fig. 53). Menu options for subject outline searching in a redesigned experimental online catalog are presented in fig. 69.

```
Menu 41   --------------------------------------------------------
         | SA  (see fig. 57)                                      |
         | SS  Search subject outline for subject (1) ============|==>Menu 42
         | SD  (see fig. 65)                                      |
         | SC  (see fig. 51)                                      |
         | MR  Modify results ====================================|==>fig. 53
         | RS  Review searches ===================================|==>fig. 53
          --------------------------------------------------------

Menu 42   --------------------------------------------------------
         | [ List of Perspectives ]                               |
         | BP  Browse a perspective ==============================|==>Menu 43
         | SO  Start over ========================================|==>Menu 41
          --------------------------------------------------------

Menu 43   --------------------------------------------------------
         | [ List of Topics ]                                     |
         | BG  Browse more general topics                         |
         | BS  Browse more specific topics                        |
         | GN  Get detailed notes for a topic                     |
         | SL  Select line(s) to display items ===================|==>Menu 44
         | RP  Return to perspectives list =======================|==>Menu 42
         | SO  Start over ========================================|==>Menu 41
          --------------------------------------------------------

Menu 44   --------------------------------------------------------
         | [ Brief Titles List ]                                  |
         | BF  Browse forward in title list                       |
         | BB  Browse backward in title list                      |
         | ST  Select title for full information                  |
         | RT  Return to topics list =============================|==>Menu 43
         |                                                        |   or 45
         | SO  Start over ========================================|==>Menu 41
          --------------------------------------------------------

Menu 45   --------------------------------------------------------
         | [ List of Topics ]                                     |
         | BG  Browse more general topics                         |
         | BS  Browse more specific topics                        |
         | GN  Get detailed notes for a topic                     |
         | SL  Select line(s) to display items ===================|==>Menu 44
         | SO  Start over ========================================|==>Menu 41
          --------------------------------------------------------
```

(1) Menu 45 if there is only one perspective

Fig. 69. Options for subject outline searching in a redesigned experimental online catalog

A search example of this improved procedure is found in the search for "World food problems, especially in Africa" in fig. 70. The user-entered term "food supply in africa" refers the searcher to a List of Topics constructed around "338.19 Food supply." In DOC's subject outline search without the suggested improvements, the searcher was referred to "338.1 Agriculture," because the grouping procedure of the subject outline search referred searchers to the shortest class number, not the highest posted class number for the user-entered term. In a redesigned experimental online catalog, the searcher is referred to "338.19 Food supply" which is the highest posted class number for the user-entered term.

```
What would you like to do? > ss
Enter subject to search > food supply in africa

>>>>> YOUR REQUEST...ss:food supply in africa

  Please wait ...

* ITEMS ON YOUR SUBJECT ARE FOUND UNDER 338.19 IN THIS OUTLINE OF RELATED
  SUBJECTS.

GENERAL TOPIC:  338.1 Agriculture
    LINE  ITEMS  AREA            TOPIC
       A     54  338.13          Financial aspects   Prices
       B      4  338.14          Factors affecting production
       C      0  338.15          Surpluses and shortages of farm products
       D     52  338.16          Production efficiency
       E    148  338.17          Products and groups of products
       F     96  338.18          Government farm policies
     * G     69  338.19          Food supply

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    SO  Start over
```

Fig. 70. Subject outline searching for "World food problems, especially in Africa" in a redesigned experimental online catalog (cont. on next page)

```
What would you like to do? > sl g

>>>>> YOUR REQUEST...sl g
       69 ITEMS IN SET 5  (338.19 Food supply)

FULL CALL NUMBER, BRIEF TITLE, AND YEAR OF ITEMS 1-5 THAT DIRECTLY MATCH YOUR TOPIC
ARE:

LINE  CALL NUMBER/TITLE/YEAR
   A  338.196 F625/ Food production in Africa/ 1982
   B  338.196 C48/ The developmental effectiveness of food aid in Africa/ 1982
   C  338.19620096 I5/ The first five years, 1974-1978/ 1978
   D  338.1966 C34/ Food production and crisis in the West African savannah/ 1981
   E  338.1967 R8/ Imperialism, colonialism, and hunger/ 1983

FULL CALL NUMBER, BRIEF TITLE, AND YEAR OF ITEMS 6-10 IN THIS SAME SHELF AREA ARE:

   F  338.19 B48/ Coping with hunger/ 1982
   G  338.19 F25/ FAO principles of surplus disposal and consultative oblig/ 1980
   H  338.19 F58/ Food policy/ 1981
   I  338.19 R6/ The population-food squeeze/ 1980
   J  338.19 S41/ A series of papers on world food issues/ 1979

OPTION
    BF  Browse forward in title list
    BB  Browse backward in title list
    ST  Select title for full information
    RT  Return to topics list
```

Fig. 70. Subject outline searching for "World food problems, especially in Africa" in a redesigned experimental online catalog (continued)

The experimental online catalog refers the searcher to a topic which expresses one facet (food supply) of the user's expressed topic. When the searcher selects line G in the List of Topics in fig. 70 and displays retrieved items, the first items listed are direct matches of the user-entered term which are relevant to his expressed topic. If these five direct matches of the user-entered term had not been the first ones displayed in the subject outline search, the searcher would have displayed 39 items before displaying items that treat "Africa."

The procedure of displaying direct matches first in the display of retrieved items has directed the user in his search for "World food problems, especially in Africa" to a relevant synthesized class number area, 338.196, for items on this topic. Once he arrives at this shelf location, he will not only find the five items first displayed in the subject outline search, but other items on this topic and specifically named African countries. These items with titles like Silent violence: food, famine and peasantry in Northern Nigeria and Food shortage survey report on Wolaita Awraja were not among the five titles listed above because they did not contain the user-entered term in the fields indexed for subject outline searches.

The results of the subject outline search in fig. 69 do not necessarily require modification by limiting or entering another subject search, because retrieved and displayed items are relevant to the user's expressed topic. But the searcher still has the capability to modify the results listed in the options following the creation of a set of items. Let's say that the user wants to limit the 69 retrieved items to ones published from 1983 to the present. The user-system interaction in which the experimental online catalog assists the searcher through the complicated processing of limiting retrieved items by year of publication is presented in fig. 71.

```
What would you like to do? > so

OPTION DESCRIPTION
    SA  Search alphabetically for subject
    SS  Search subject outline for subject
    SD  Search directly for subject
    SC  Search for call number
    MR  Modify results
    RS  Review searches


What would you like to do? > mr

>>>>> YOUR REQUEST...mr

OPTION  DESCRIPTION
    MY  Modify results by year of publication
    ML  Modify results by language
    MS  Modify results by another subject
    MP  Modify previous results


What would you like to do? > my

>>>>> YOUR REQUEST...my

   THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
   SET  ITEMS    REQUEST
   1       69    SS:339.19 Food supply

Enter sets (separated by commas) to modify > 1
Enter earliest year > 1983
Enter latest year > 1985

>>>>> YOUR REQUEST...my 1983-1985
        2  ITEMS IN SET 2 (1 AND 1983-1985)
•
•
•
```

Fig. 71. Modifying a subject outline search for "World food problems, especially in Africa" by year of publication

In this description of the subject outline search, online catalog users are limited to searching, browsing, and displaying the DDC Schedules. If synthesized class numbers are coded in classification fields of bibliographic records, searchers would be able to search, browse, and display portions of the DDC Schedules and Tables retrieved by the user-entered term. In an online catalog with coded synthesized class numbers, the index of the subject outline search comprises words from the (1) DDC Relative Index, (2) DDC Schedules and notes, and (3) DDC Tables and notes. Words from first-listed subject headings in bibliographic records are not included in the searchable index of the subject outline search. Thus, this implementation of the subject outline search only contains words from subject-rich fields of the DDC.

The process of subject outline searching is not changed from the process depicted in fig. 68 in a subject outline search whose index is composed of words from subject-rich fields of the DDC, i.e., Schedules, Relative Index, and Tables. Because this subject outline search has been enhanced with the DDC Tables, searchers not only can search, browse, and display the Tables, they can also retrieve bibliographic records bearing Table class numbers and combine these results with records retrieved from searching, browsing, and displaying the Schedules. Fig. 72 shows a subject outline search for "World food problems, especially in Africa" in which the user performs a subject outline search for "Agriculture" in the DDC Schedules and a subject outline search for "Africa" in the DDC Tables and combines the results of both searches in a Boolean AND operation.

In fig. 72, the user-entered term "agriculture in africa" results in six perspectives. Selecting the perspective "Production" (i.e., class number 338.1), the searcher retrieves a total of 615 items. Some of these retrieved items bear class numbers beginning with the Schedules class number 338.1. Other items bear class numbers in which the class number 338.1 is embedded. For example, items with the class number 016.3381 are retrieved (which are bibliographies of agricultural production), because synthesized class numbers are coded as to the source of numbers in the DDC Schedules and Tables; the number 016 for "Bibliographies" is derived from the Schedule and the number 3381 for "Agriculture" is derived from the Schedule and concatenated onto 016.

The searcher continues the search by returning to the List of Perspectives and choosing the perspective for "Africa." A List of Topics is constructed around the selected perspective "Africa" from which the searcher can browse more specific topics to obtain Lists of Topics naming African countries and regions and create sets for specific countries and regions, e.g., "-63 Ethiopia" and "-669 Nigeria and islands of Gulf of Guinea." Instead, the searcher selects the listed topic "-6 Africa" to create a set of 6,331 items whose synthesized class numbers are coded and contain this Table reference; postings in Lists of Topics are cumulative so records are retrieved with the exact Table reference -6 and beginning with this Table number, such as -63 and -669. Thus, the searcher has created a set of items on Africa and specific African countries and regions.

The searcher then modifies the results of the first subject outline search for "Agriculture" and the second subject outline search for "Africa" by combining the two separate sets together in a Boolean AND operation. A total of 40 items are retrieved and displayed. Not every brief title displayed specifically refers to Africa, but the class numbers 338.1 and -6 are embedded in the class numbers of retrieved items. If the searcher had selected and created a set for the Table class number "-63 Ethiopia" by browsing more specific topics than those listed with "Africa" and combined this set with the first set on "338.1 Agriculture," he would have retrieved two items, i.e., Food shortage survey report on Wolaita Awraja (338.19632 E83) and Field trip report on Bale & Sidamo (338.19632 F53). If the searcher had selected and created a set from Table number "-669 Nigeria and islands of Gulf of Guinea," he would have retrieved seven items, such as Cattle husbandry in Nigeria (338.1762309669 F74), Agricultural development policy and basic needs satisfaction (338.18669 B36), and Silent violence: food, famine & peasantry in northern Nigeria (338.196695 W3).

Building the indexes of the subject outline search with the DDC enables subject searchers to browse the Tables and Schedules for their topic of interest and to refine their topic of interest by browsing more specific topics and/or modifying the results. Searchers can also retrieve items on a general topic and save themselves the bother of entering specific topics into the catalog as in the subject outline search example in fig. 71 in which the searcher retrieved items on Africa and specific African countries and regions without having to enter all the specific country names and regions into the catalog. In a redesigned experimental online catalog, searchers can also obtain results for a multi-faceted search topic such as "World food problems, especially in Africa." They can search for each facet individually using the special browsing and display capabilities of the subject outline search and combine the results together through the catalog's modification capabilities; however, the end result of such a search is a list of titles that are not necessarily in the same or nearby shelf locations.

```
-----------------------------------------------------------------------------------------------
Subject Outline Search                                        Explanation
-----------------------------------------------------------------------------------------------
What would you like to do? > ss
Enter subject to search > agriculture in africa

>>>>> YOUR REQUEST...ss:agriculture in africa                 User-entered term "agriculture
                                                              in africa" results in the
  Please wait ..........................                      creation of six perspectives
YOUR SUBJECT IS TREATED FROM 6 PERSPECTIVES:                  in a subject outline
                                                              search.
LINE  PERSPECTIVES
   A  Agriculture and relateo technologies
   B  Production
   C  Journalism
   D  Secondary education
   E  Publication administration
   F  Africa

OPTION  DESCRIPTION
    BP  Browse a perspective
    SO  Start over


What would you like to do? > bp b                             User selects the second-listed
                                                              perspective in which
>>>>> YOUR REQUEST...bp b                                     agriculture is treated from the
                                                              perspective of production.
```

Fig. 72. Subject outline search for "World food problems, especially in Africa" with online browsing displays of DDC Schedules and Tables (cont. on next page)

```
-----------------------------------------------------------------------------------------------------------
Subject Outline Search                                                               Explanation
-----------------------------------------------------------------------------------------------------------
* ITEMS ON YOUR SUBJECT ARE FOUND UNDER 338.1 IN THIS OUTLINE OF RELATED
  SUBJECTS.

GENERAL TOPIC : 338 Production
    LINE  ITEMS  LOCATION          TOPIC
      A    190   338.0             General aspects. Examples: Journals, Study
    * B    615   338.1             Agriculture
      C    172   338.2             Extraction of minerals
      D     47   338.3             Other extractive industries
      E    648   338.4             Secondary industries and services
      F    171   338.5             General production economics
      G    158   338.6             Organization of production
      H    200   338.7             Organizations and their structure
      I    123   338.8             Combinations
      J    882   338.9             Economic development and growth

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    RP  Return to perspectives list
    SO  Start over

What would you like to do? > sl b

>>>>> YOUR REQUEST...sl b
      615 ITEMS IN SET 1 (338.1 Agriculture)

•
•
•
```

The user selects the specific topic to which he was referred by the perspective. After displaying a few retrieved items, the user continues his search by browsing another perspective.

```
OPTION  DESCRIPTION
    BS  Browse more specific topics
    BG  Browse more general topics
    GN  Get detailed notes on a topic
    SL  Select lines to display items
    RP  Return to perspectives
    SO  Start over

What would you like to do? > rp

LINE  PERSPECTIVES
   A  Agriculture and related technologies
   B  Production
   C  Journalism
   D  Secondary education
   E  Public administration
   F  Africa

What would you like to do? > bp f

>>>>> YOUR REQUEST...bp f
```

The searcher selects the perspective "Africa." A List of Topics from the DDC Tables is constructed around the selected topic "-6 Africa."

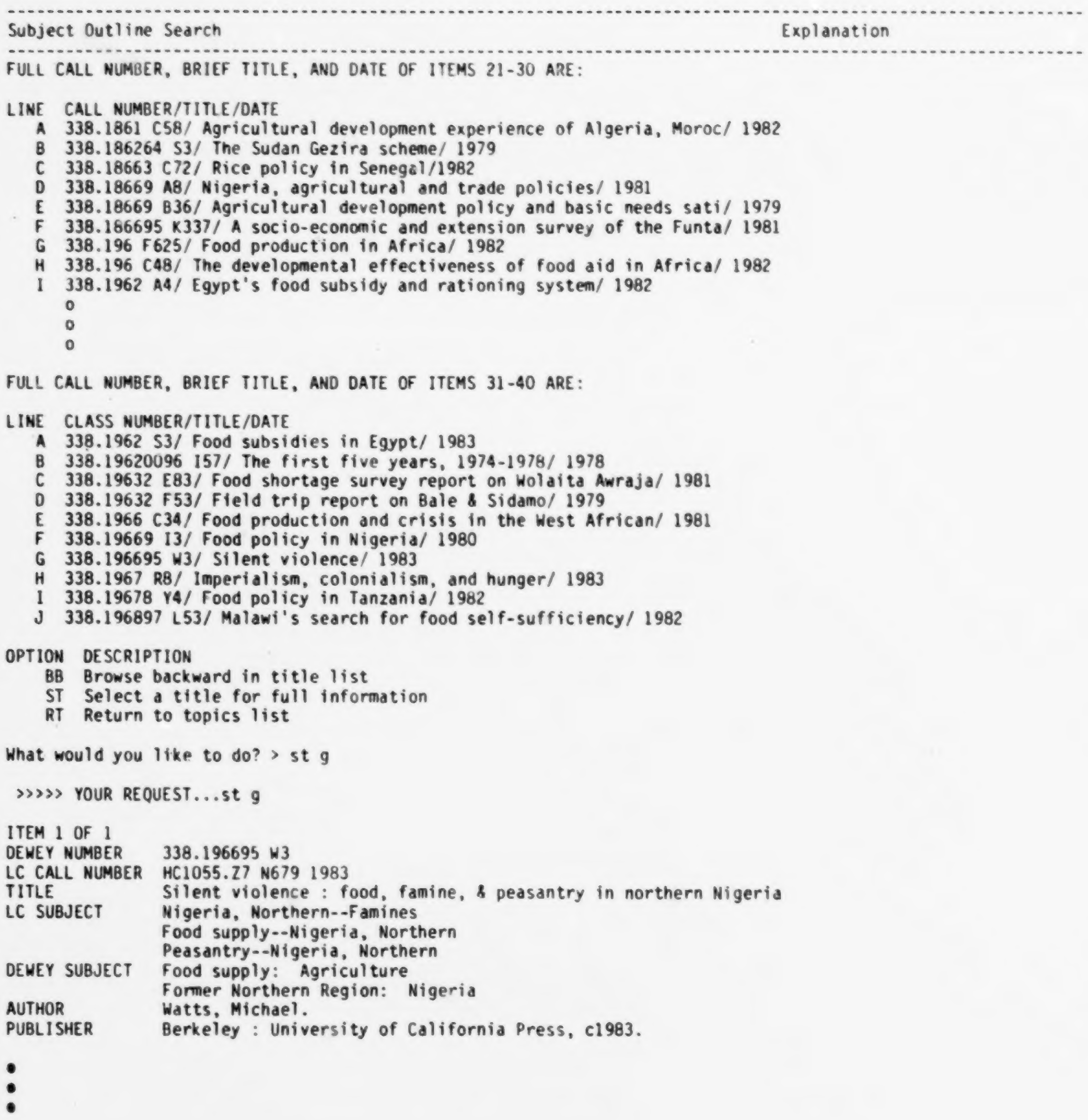
Fig. 72. Subject outline search for "World food problems, especially in Africa" with online browsing displays of DDC Schedules and Tables (cont. on next page)

```
-------------------------------------------------------------------------------------------------------------
Subject Outline Search                                                         Explanation
-------------------------------------------------------------------------------------------------------------
* ITEMS ON YOUR SUBJECT ARE FOUND UNDER -6 IN THIS OUTLINE OF RELATED SUBJECTS.
  USE THESE RESULTS TO MODIFY YOUR SEARCH.

GENERAL TOPIC : Areas
    LINE  ITEMS  AREA          TOPIC
       A    586  -1            Areas, regions, places in general
       B    423  -2            Persons regardless of area, region, place
       C   5611  -3            The ancient world
       D  10298  -4            Europe Western Europe
       E   7008  -5            Asia  Orient  Far East
     * F   6331  -6            Africa
       G  29802  -7            North America
       H   6210  -8            South America
       I   9014  -9            Other parts of world and extraterrestrial worlds

OPTION  DESCRIPTION
    BG  Browse more general topics                                             The searcher can browse more
    BS  Browse more specific topics                                            specific topics for "Africa"
    GN  Get detailed notes for a topic                                         to retrieve items on specific
    SL  Select line(s) to display items                                        African countries and
    RP  Return to perspectives list                                            regions.
    SO  Start over

What would you like to do? > sl f

>>>>> YOUR REQUEST...sl f
     6331 ITEMS IN SET 2 (-6 Africa)                                           The searcher selects a listed
                                                                               topic and creates a set
•                                                                              of 6,331 items.
•
•

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    RP  Return to perspectives list
    SO  Start over

What would you like to do? > so

>>>>> YOUR REQUEST...so

OPTION  DESCRIPTION
    SA  Search alphabetically for subject
    SS  Search subject outline for subject
    SD  Search directly for subject
    SC  Search for call number
    MR  Modify results
    RS  Review searches

What would you like to do? > mr                                                At this point, the searcher is
                                                                               going to modify the results of
>>>>> YOUR REQUEST...mr                                                        two highly posted sets.

OPTION  DESCRIPTION
    MY  Modify results by year of publication
    ML  Modify results by language
    MS  Modify results by another subject
    MP  Modify previous results
```

Fig. 72. Subject outline search for "World food problems, especially in Africa" with online browsing displays of DDC Schedules and Tables (cont. on next page)

```
------------------------------------------------------------------------------------------------
Subject Outline Search                                                    Explanation
------------------------------------------------------------------------------------------------
What would you like to do? > mp                                           The searcher selects an option
                                                                          to modify the results of
>>>>> YOUR REQUEST...mp                                                   previously created sets.
                                                                          The system provides a
   THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:                           Summary of Searches display
   SET  ITEMS    REQUEST                                                  to remind the searcher of his
     1    615    ss:338.1 Agriculture                                     previous searches.
     2   6331    ss:-6 Africa

OPTION  DESCRIPTION
    FI  Find items common to 2 or more sets
    II  Include items from 2 or more sets
    EI  Exclude items from 2 or more sets
    SO  Start over
                                                                          The searcher combines sets 1
What would you like to do? > fi                                           and 2 in a Boolean AND
Enter set numbers (separated by commas) > 1,2                             operation.  The result is
                                                                          40 items.
>>>>> YOUR REQUEST...fi 1 and 2
        40 ITEMS IN SET 3 (1 AND 2)

FULL CALL NUMBER, BRIEF TITLE, AND YEAR OF ITEMS 1-10 ARE:

LINE  CALL NUMBER/TITLE/YEAR
   A  338.13096894 M34/ Report on rural-urban terms of trade/ 1982        Brief title display of the 40
   B  338.1309689 M54/ Price responses of Malawi smallholder farmers--    retrieved items contains titles
      fast/ 1975                                                          on agricultural production in
   C  338.16109669 A36/ Agricultural mechanisation improvement programme/ Africa.
      1980
   D  338.173109678 N36/ The impacts of inter-regional transport subsidy
      policy o/ 1980
   E  338.173180966 W5/ The prospect of achieving self-sufficiency in rice
      produc/ 1980
   F  338.17318096652 S75/ Strategy for the development of rice cultivation
      in the/ 1979
   G  338.1731809667 P722/ Economic study of rice production, marketing, and/
      1981
   H  338.17318096683 L48/ Rice production systems in Benin/ 1979
   I  338.173510967827 R34/ Cotton production in West-Lake Region, Tanzania/ 1976
   J  338.1736109667 O39/ An economic review of the sugar industry in Ghana/ 1979
      •
      •
      •

FULL CALL NUMBER, BRIEF TITLE, AND YEAR OF ITEMS 11-20 ARE:

LINE  CALL NUMBER/TITLE/YEAR
   A  338.17361096982 S94/ Sugar in Mauritius/ 1982                       Items are displayed in shelf-
   B  338.173730967827 R34/ Coffee production in West-Lake Region,        list order.  Th results of
      Tanzania/ 1976                                                      this subject outline
   C  338.1760096762 W34/ District ranch development briefs/ 1979         search are like browsing
   D  338.1760096811 O33/ Botswana's first livestock development          a shelflist of items
      project / 1980                                                      classed in 338.1 which
   E  338.17620096894 L8/ Limitations and possibilities of increasing     are only about Africa.
      market prod/ 1971
   F  338.1762309669 F74/ Cattle husbandry in Nigeria/ 1979
   G  338.177096762 B87/ Kenya's experience in rural dairy development
      education/ 1980
   H  338.1770968792 S53/ Dairying as an instrument for rural development
      in the/ 1981
   I  338.186 G56/ Agrarian policies and rural poverty in Africa/ 1983
      •
      •
      •
```

Fig. 72. Subject outline search for "World food problems, especially in Africa" with online browsing displays of DDC Schedules and Tables (cont. on next page)



```
----------------------------------------------------------------------------------------------------
Subject Outline Search                                                   Explanation
----------------------------------------------------------------------------------------------------
FULL CALL NUMBER, BRIEF TITLE, AND DATE OF ITEMS 21-30 ARE:

LINE  CALL NUMBER/TITLE/DATE
   A  338.1861 C58/ Agricultural development experience of Algeria, Moroc/ 1982
   B  338.186264 S3/ The Sudan Gezira scheme/ 1979
   C  338.18663 C72/ Rice policy in Senegal/1982
   D  338.18669 A8/ Nigeria, agricultural and trade policies/ 1981
   E  338.18669 B36/ Agricultural development policy and basic needs sati/ 1979
   F  338.186695 K337/ A socio-economic and extension survey of the Funta/ 1981
   G  338.196 F625/ Food production in Africa/ 1982
   H  338.196 C48/ The developmental effectiveness of food aid in Africa/ 1982
   I  338.1962 A4/ Egypt's food subsidy and rationing system/ 1982
      o
      o
      o

FULL CALL NUMBER, BRIEF TITLE, AND DATE OF ITEMS 31-40 ARE:

LINE  CLASS NUMBER/TITLE/DATE
   A  338.1962 S3/ Food subsidies in Egypt/ 1983
   B  338.19620096 I57/ The first five years, 1974-1978/ 1978
   C  338.19632 E83/ Food shortage survey report on Wolaita Awraja/ 1981
   D  338.19632 F53/ Field trip report on Bale & Sidamo/ 1979
   E  338.1966 C34/ Food production and crisis in the West African/ 1981
   F  338.19669 I3/ Food policy in Nigeria/ 1980
   G  338.196695 W3/ Silent violence/ 1983
   H  338.1967 R8/ Imperialism, colonialism, and hunger/ 1983
   I  338.19678 Y4/ Food policy in Tanzania/ 1982
   J  338.196897 L53/ Malawi's search for food self-sufficiency/ 1982

OPTION  DESCRIPTION
    BB  Browse backward in title list
    ST  Select a title for full information
    RT  Return to topics list

What would you like to do? > st g

 >>>>> YOUR REQUEST...st g

ITEM 1 OF 1
DEWEY NUMBER      338.196695 W3
LC CALL NUMBER    HC1055.Z7 N679 1983
TITLE             Silent violence : food, famine, & peasantry in northern Nigeria
LC SUBJECT        Nigeria, Northern--Famines
                  Food supply--Nigeria, Northern
                  Peasantry--Nigeria, Northern
DEWEY SUBJECT     Food supply:  Agriculture
                  Former Northern Region:  Nigeria
AUTHOR            Watts, Michael.
PUBLISHER         Berkeley : University of California Press, c1983.

•
•
•
```

Fig. 72. Subject outline search for "World food problems, especially in Africa" with online browsing displays of DDC Schedules and Tables (continued)

9.5.3 Functions of a Centralized Online Cataloging System

The classificatory tasks performed by library technical services staff can be facilitated by searching, browsing, and assignment capabilities of up-to-date, machine-readable classification records in centralized online cataloging systems. When the classifier has a book in hand for classifying, the classifier's search objectives are

1. To find the Schedule class numbers, captions or notes, or Table class numbers, captions, or notes bearing or expressing the user-entered class number or term. For example,

    - What is the Table number for "Papua New Guinea"?
    - What Schedule captions or notes are specific to the topic of "Cottage industries"?

2. To find the class numbers assigned to items bearing a particular subject heading. For example,

    - What class numbers are common to items bearing the subject heading, "Small business--Management"?
    - What class number is usually assigned to items on "Set theory"?

3. To find out the subject of items with a particular class number. For example,

    - Is the subject of books classed into 917.4799 the same as this early 19th century handbook on tours of Niagara Falls?
    - Have we been assigning 796.3523 to books on improving your golf swing?

4. To find the class numbers assigned to items on a new topic for which there are too few or no subject headings to establish a consistent pattern of assignment,

    - What class number has been assigned to books on Star Wars warfare?
    - Where are items classed on U.S. trade with Vietnam after the recent communist takeover?

Library classifiers can benefit from the variety of online subject searching capabilities that are also available to library patron searchers to access the online cataloging system's database of classification authority records and/or database of cataloging records, i.e., class number searching (section 9.5.2.1); alphabetical searching (section 9.5.2.2); direct searching (section 9.5.2.3); and subject outline searching (section 9.5.2.4).

Alphabetical searching is based on three different types of controlled terms: (1) Relative Index entries which would be distributed by Forest Press in classification authority records for Schedule and Table class numbers, (2) subject heading authority records which would be distributed by the Library of Congress, and (3) subject headings in bibliographic records in the cataloging database. In an online cataloging system, these three types of controlled terms can be linked to the classification practice of libraries expressed in millions of cataloging records while maintaining the information in the original distribution from Forest Press and LC.

In an online cataloging system, Relative Index entries would be processed into an index containing (1) the class number found in the entry, (2) the entry itself, (3) pointers to the bibliographic records containing the entry and/or bearing the same class number as the entry, and, (4a) in the case of a Schedules class number, a pointer to the Schedule authority record bearing the same class number as the entry, or, (4b) in the case of a Tables class number, a pointer to the Table authority record bearing the same class number as the entry.

Subject heading authority records distributed from the Library of Congress contain the information assigned by LC, such as the LC class number or range associated with the heading (053 field), the subject heading itself (150 or 151 fields), and "see also from" references (550 or 551 fields). After the subject headings in these authority records are processed into the online cataloging database, an index is created which contains (1) pointers to the bibliographic records assigned the subject heading and (2) class numbers and number of bibliographic records assigned the subject heading and pointers to these bibliographic records. The "see also from" references of these LC-supplied subject heading authority records are also processed into the online cataloging system so that "see also" references and the number of occurrences (including zero occurrences) of the "see also" reference in the online cataloging database are added to LC-supplied subject heading authority records.

An index of subject headings in the bibliographic records of the online cataloging database for which there are no subject heading authority records in the LC-supplied data is created which contains (1) pointers to bibliographic records assigned the subject heading and (2) class numbers and number of bibliographic records assigned the subject heading and pointers to these bibliographic records. The difference between subject headings from bibliographic records in the online cataloging database and subject headings in LC-distributed subject heading authority records is that the latter have authority records in the system with "see also," "see also from," and/or "see" references.

In an alphabetical search, the library classifier enters a term and the system responds with an alphabetical list of subject headings and Relative Index entries in the neighborhood of the user-entered term. The classifier can enter a term accompanied by a field delimiter(s) for an LC-distributed subject heading and/or local subject heading, or Relative Index entry to restrict the alphabetical list to one or more types of controlled terms. An alphabetical list of controlled terms is shown which results from the user-entered term "Small business."

```
>>>>> YOUR REQUEST...sa:small business

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
LINE  ITEMS  SUBJECTS [DLC OR L] AND ENTRIES [DDC]
   A      0  Slums [DDC]
   B      1  Slums [L]
*  C     21  Small business [DLC]
   D      2  Small business enterprises--India--Andra Pradesh [L]
   E      1  Small business investment companies--United States [L]
   F      1  Small business investment companies--United States--Directories [L]
   G      4  Small businesses: Investment in: Financial economics [DDC]
   H      9  Small businesses: Financial management [DDC]
   I     37  Small businesses: Management [DDC]
   J      1  Small businesses: Personnel management [DDC]

OPTIONS:  SL, BB, BF, others
```

This alphabetical list is similar to the one produced in response to a user-entered term in a redesigned experimental online catalog (fig. 58). However, it shows the source of the controlled term, i.e., when DLC is an LC-distributed subject heading, L is a local subject heading used in the cataloging database, and DDC is a Relative Index entry. The classifier can browse forward in this alphabetical list, select a listed heading(s) and/or entry(ies), or enter any option (in a command-based mode) that the classifier feels is necessary to further or terminate the search. In this example, the classifier selects lines C and I. The system response is the creation of two separate sets for the selected controlled terms and a system prompt to find out whether the user is interested in displaying retrieved bibliographic records (DI), displaying class number locations of items in which this selected heading is the first-listed subject heading (DL), or displaying related headings or captions (DR).

```
>>>>> YOUR REQUEST...sl c,i
       21 ITEMS IN SET 1 (Small business [DLC])
       37 ITEMS IN SET 2 (Small business: Management [DDC])

OPTIONS:  DI, DL, DR, others

What would you like to do? > dl
Enter set number > 1
```

The classifier chooses the option to display class numbers of items in which the subject heading "Small Business" is the first listed subject heading.

```
>>>>> YOUR REQUEST...dl 1

Subject heading:  Small business [DLC]
LINE  ITEMS  BOOKSHELF LOCATIONS/TOPIC
   A      4  658.022 Small: Management of enterprises of specific sizes
             and scopes
   B      2  338.642 Small business: Size of enterprises

OPTIONS:  SL, SB, others
```

There are six items in the online cataloging database in which the heading "Small business" is the first listed heading. Four items bear the class number 658.022 and two items bear the number 338.642. This display is similar to the Bookshelf Locations List in an online catalog (fig. 59). Whereas patrons will use this display to browse a fruitful bookshelf for books on their topics of interest, library staff will use this display to identify candidate class numbers for the book in hand. The classifier can now select the items to display these items (SL), or select each line, one at a time, to display a List of Topics constructed around each number to scan other items bearing the listed class number (SB). For example, if the classifier chooses the latter option (SB) and selects the higher posted of the two numbers, a List of Topics is constructed around 658.022.

```
>>>>> YOUR REQUEST...sb a

* ITEMS ON YOUR SUBJECT ARE FOUND UNDER 658.022 IN THIS OUTLINE OF RELATED
  SUBJECTS.

GENERAL TOPIC : 658.02 Management of enterprises of specific sizes
    LINE  ITEMS  CLASS NUMBER     CAPTION
    *  A     37  658.022          Small
       B      1  658.023          Large

OPTIONS:  BS, BG, SL, GS, GC, others
```

The options following this List of Topics enable the classifier to browse specific and general Schedule captions (BS, BG), select a listed line(s) to display items (SL), or select a listed line to get subject-rich Schedule notes (GS), i.e., including, example, general, or class here notes, Relative Index entries, and possibly, first-listed subject headings of bibliographic records. These options were also provided to online catalog searchers in comparable displays in alphabetical searches (fig. 60). But classifiers can also get classification notes in the Schedules (GC), i.e., the classification authority record for a DDC Schedule or Table record. Selecting the GC option, the classifier obtains a display of the classification notes for 658 (see appendixes A and B for explanation of field labels):

```
(Class number:)     me   658
(Caption:)          met  General management
(Schedule notes:)   not  The science and art of conducting organized
                         enterprises, projects, activities
                    not  Planning, organizing, financing, staffing, directing,
                         coordinating, controlling, reporting, other functions
                         common to all types of enterprises
                    nch  Class here services rendered by nonpublic
                         organizations, whether or not for profit; services
                         rendered by public corporations and agencies of
                         government which in nonsocialist societies are
                         frequently rendered by private organizations, e.g.,
                         education, transportation, hospital services
                    nce  Class management of enterprises engaged in specific
                         fields of activity [formerly 658] with the subject,
                         using "Standard Subdivisions" notation 068 from Table
                         1, e.g., management of mines 622.068, of commercial
                         banks 332.12068
                    nce  Class sociology of management in 302.3, 306.3, specific
                         principles of management in 658.401-658.403
                    ncr  For public administration, see 350
(Relative Index     dri  Business management
entries:)           dri  Management
                    dri  Programming--General management
```

Following the selection of an LC-distributed subject heading from the alphabetical list, classifiers can display the bibliographic records assigned the heading (DI), or display related subject headings (DR), such as "see," "see also," and "see also from" references. The subject heading "Small business" has the following subject-rich, LC-supplied fields and subfields and system-supplied "see also" references (sa):

```
150  0  Small business
550  0  Industries, Size of
550  0  Self-employed
550  0  United States ‡x Commerce
550  0  United States ‡x Industries
550  0  United States ‡x Manufactures
680       Here are entered works on small independent businesses as contrasted
          with "big business" in general and in the United States as a whole.
          Works on small business in particular states or localities of the
          United States or in countries, cities, etc., outside the United States
          are entered under Small business--[local subdivision], e.g., Small
          business--New Orleans.
sa        Cottage industries
sa        Franchises (Retail trade)
sa        Industries, Size of
```

Alphabetical searching in an online cataloging system enables classifiers to find the class numbers assigned to items bearing a particular controlled vocabulary term through the same capability that led online catalog users to bookshelf browsing areas following the selection of a subject heading or Relative Index entry in alphabetical searches (figs. 59 and 61). This capability can help classifiers to find the Schedule or Table class number for a particular topic (expressed as a subject heading or Relative Index entry).

In class number searching, the classifier has already identified a class number of interest from a previous search, a note in the Schedules or Tables, or his previous experience and knowledge of the classification. The classifier needs to display the subject-rich Schedule notes, classification notes in the Schedule, or bibliographic records with a particular class number. His objective may be to find out the subject of items with a particular class number or to review the Schedule notes for a particular class number and nearby numbers to determine whether a candidate number is appropriate to assign to a book given its assignment to records in the past. The user-entered class number may match a class number in the DDC Schedule or Tables or match a synthesized class number in bibliographic records. When the user-entered class number is enumerated in the Schedules or Tables, the result is a List of Topics that is constructed around the user-entered class number. The List of Topics resembles online catalog displays in class number searches by library patrons (fig. 52). If the user-entered class number is 2-99, the system response is a List of Topics constructed around class number -99 in Table 2:

```
>>>>> YOUR REQUEST...sc:2-99

* ITEMS ON YOUR CLASS NUMBER ARE FOUND UNDER -99 IN THIS OUTLINE OF
  RELATED SUBJECTS
```

```
GENERAL TOPIC:  -9 Other parts of the world and extraterrestrial worlds.
Pacific Ocean islands (Oceania)
    LINE  ITEMS  CLASS NUMBER  CAPTION
       A    105    -93         New Zealand and Melanesia
       B    291    -94         Australia
       C     28    -95         New Guinea (Papua)
       D     16    -96         Other parts of Pacific Polynesia
       E      3    -97         Atlantic Ocean islands
       F     46    -98         Arctic islands and Antarctica
     * G     66    -99         Extraterrestrial worlds
OPTIONS:  BS, BG, SL. GS, GC, others
```

The classifier's options in this search are to browse more specific or general captions (BG or BS), or to select a listed caption to display subject-rich Table notes or classification notes (GS or GC). The classifier can also select a listed caption to modify the results in a number of ways (SL), e.g., combining the results with alphabetical search results using the Boolean AND operator or limiting the results by a year or range of years of publication.

When the classifier enters a built class number, the system response is a shelflist browsing display of brief title information. This is the same system response as an online catalog's response to a patron's entry of a built number (fig. 55).

```
>>>>>  YOUR REQUEST...sc:917.4799

LINE  CLASS NUMBER/TITLE/DATE
   A  917.4798 B814/ Niagara/ 1972
   B  917.4798 S561/ Wonders of Niagara/ 1914
   C  917.4799 B25/ Descriptions of Niagara selected from various travelers/ 1847
   D  917.4799 B622/ Red book of Niagara/ 1901
   E  917.4799 B827/ Emily and Clara's trip to Niagara Falls/ n.d.
   F  917.4799 B85/ Brief memories of Niagara/ 187-
   G  917.4799 B92/ Lengthening of Niagara Falls/ 1927
   H  917.4799 C641/ Sketches of Niagara Falls and river/ 1846
   I  917.4799 D489/ Falls of Niagara, or Tourist's guide to this wonder of/ 1839
   J  917.4799 E21/ New guide and key to Niagara Falls/ 1920
OPTIONS:  BF, BB, ST, others
```

At the end of the brief titles list, the classifier can browse backward or forward (BB or BF) in the list to display brief title information for titles shelved before or after the ten listed titles or display full bibliographic information (ST) for one or more titles. If the classifier displays full bibliographic information in MARC format for a selected title, he can examine the class number field to find out how the class number 917.4799 was synthesized from the DDC Schedules and Table 2 (i.e., ǂe910 ǂf2 ǂg74799). Then, the classifier may follow this up with two class number searches for Schedule class number 910 and Table class number -74799 to review the classification notes under each class number. The classifier would probably want to consult both sets of classification notes for 910 and -74799 while assigning the number to a book at hand. Thus, the online cataloging system must have a multiple-windowing capability to enable the classifier to temporarily suspend the ongoing search to consult one or more Schedules and/or Table class numbers.

Subject outline searching enables the classifier to enter a term into the catalog and retrieve the class number area(s) where there are items containing the user-entered term (fig. 68). The classifier is not required to enter a term that matches a subject heading or Relative Index entry as in alphabetical searching and can match words in a Relative Index entry, a Schedule caption, and/or first-listed subject headings in bibliographic records. If Schedule and Table information has been coded into the class number fields of bibliographic records, it is not necessary to include first-listed subject headings in the index of the subject outline search because of duplication between the DDC Tables and subject headings and the searching problems caused by these headings in subject outline searches (see sections 8.4.5 and 8.4.7).

The failure analysis of subject outline searches (section 8.4) emphasized the problems of this search and recommended improvements. The grouping procedure of the subject outline search should be changed so that a List of Topics is constructed around the highest posted DDC class number in a group (see section 5.5.2.4, item 6.a). The first items displayed in subject outline searches are those that would be retrieved in a direct search for the user-entered term and bear the class number of the List of Topics.

If Schedule and Table information is coded in the classification number fields of bibliographic records, the intermediate result of a subject outline search will be a List of Perspectives composed of perspectives from both Tables and Schedules. Listed perspectives can be chosen and the sets created from listed topics. These sets of items retrieved by the classifier's selections of listed topics can then be combined using Boolean operations (fig. 71). For example, the user-entered term "Economic development in the Soviet Union" results in a number of perspectives, including (1) "Union of Soviet Socialist Republics (Soviet Union)" with Table class number -47, and (2) "Economics" with Schedules class number 330. The classifier follows through searches for both perspectives and, later, combines the results of these searches using the Boolean AND operator to obtain relevant items for his topic. The classifier can also follow through a search for one or more perspectives and modify the result through the use of alphabetical, direct, or class number searches and Boolean operators. Subject outline searches refer classifiers to class numbers based on the system's matching of their term with words in a Schedule caption or note, Relative Index entry, and first-listed subject heading in a bibliographic record (or Table captions and notes). Once the classifier identifies the appropriate class number(s) through the subject outline search, he will want to display the classification notes for the Schedules or Table class number. Thus, the List of Topics allows staff to both select a topic to display bibliographic records and the classification authority record for a Schedules or Table class number.

Direct searches in an online cataloging system allow the classifier to search entire bibliographic records and classification authority records, or selected fields in bibliographic records and/or classification authority records. The user-entered term "extraterrestrial worlds" with a delimiter for classification authority records in a direct search would retrieve at least two classification authority records from the Tables ("-9 Other parts of world and extraterrestrial worlds. Pacific Ocean islands [Oceania]" and "-99 Extraterrestrial worlds"), and one authority record from the Schedules ("215.24 life on other worlds" [with the Relative Index entry "Extraterrestrial worlds"]). The user-entered term "extraterrestrial worlds" with delimiters for fields added to the bibliographic records by the classification would retrieve bibliographic records with the Table numbers -9, -99, and Schedule number 215.24. The user-entered term "extraterrestrial worlds" with delimiters for subject-rich bibliographic record fields in a direct search would retrieve items whose title, subject heading, series, and selected note fields contained these terms. Direct searches should also allow classifiers to enter exact and truncated class numbers to find the number of bibliographic records bearing the number and to modify the results by combining them with the results of another search(es) using Boolean operators or other modification capabilities. Direct searches enable classifiers to match their entered terms or class numbers with those in all or selected subject-rich fields of bibliographic records, review retrieved items, and modify the results. With the feedback technique discussed in sections 8.3.5 and 9.5.2.3, the system should be able to analyze retrieved items in low-posted direct searches and suggest subject headings common to a number of items. Such feedback will help subject catalogers to assign subject headings to items at hand, particularly when they are having trouble finding the right subject heading to express a book's contents or appropriate heading to express a new topic.

In an online cataloging system, the classifier can be assisted in assigning class numbers to books through four different approaches:

1. Alphabetical searching of
    a. LC-distributed subject heading authority records
    b. Forest Press-distributed Relative Index entries
    c. Subject headings from bibliographic records
    d. A combination of the controlled terms above (1.a-c)

2. Class number searching of
    a. Schedules
    b. Tables
    c. Library shelflist

3. Subject outline searching of words in the
    a. Schedules
    b. Relative Index
    c. Tables (or first-listed subject headings in bibliographic records)
    d. A combination of the above sources of subject-rich data (3.a-c)

4. Direct searching of
    a. All subject-rich fields or selected fields in bibliographic records
    b. All fields or selected fields in classification authority records for the Schedules and Tables
    c. All fields or selected fields in LC-distributed subject heading authority records
    d. Forest Press-distributed authority records for Relative Index entries
    e. A combination of all subject-rich data in bibliographic and authority records

The result of the four types of subject searches can be modified by the use of one or more techniques for modifying searches:

- Restrict/limit search results
    - By classification number
    - By year of publication
    - By language
    - By format
    - By another controlled or free-text term
- Boolean operators
    - On any field in bibliographic and/or classification authority records
    - On selected fields of bibliographic and/or classification authority records
- Relational operators (i.e., explicit use of some symbolic expression of "greater than," "less than," or "equal to")
    - For a range of classification numbers
    - For a range of publication dates
- Proximity operators (i.e., explicit use of some symbolic expression to enable the user to specify the position in a field or fields of search terms vis-a-vis one another)
- Truncation

Library staff using an online cataloging system also have the ability to call up displays of bibliographic and authority data (that are not particularly useful to library patron searchers of an online catalog) but are necessary for subject cataloging and classifying:

- Classification authority records for Table and Schedule records enhanced with first-listed subject headings in bibliographic records, Relative Index entries, subject-rich Schedule notes, classifiers' notes, and *Manual* notes
- LC-supplied subject authority records enhanced with "see also" references from the online cataloging database
- Full coded MARC records enhanced with the DDC

The classifier accesses the online cataloging system to use its online aids for searching and displaying the classification. Once the classifier finds the appropriate Schedule or Table number, the online cataloging system must allow the classifier to assign the class number and subject-rich classification terms to bibliographic records automatically without having to type class numbers or terms into the bibliographic record.

The storage of classification authority records, i.e., with both subject-rich fields of information and fields specific to library staff performing classification tasks, should be done by the centralized online cataloging system. As new and updated classification authority records are obtained from Forest Press, these records should be loaded into the online cataloging system in a timely fashion. Online cataloging system users have to be informed of such records so that they can reclassify library material affected by these records and transfer new or updated records or selected fields of these records to their local online catalogs.

In the DDC Online project, we maintained all Schedule captions in browsing displays of the DDC Schedules whether they were posted or not posted. We did not maintain Relative Index entries that were not posted. When processing the DDC into a library's local online catalog, the library might not want to store unused Schedule or Table records or unused Relative Index entries. Instead, the library could rely on the centralized online cataloging system for this information when the library obtains and classifies a book in a previously unused class number in the library. However, obtaining the classification authority records for a previously unused number from the online cataloging system will not always be a straightforward process when these records are entered into a library's online catalog. For example, a library has used numbers 155 and 155.6 in the past and no more specific numbers than 155.6. Then the classifier assigns a new item to the number 155.6422. Thus, classification authority records for class numbers 155.64 and 155.642 have to be obtained from the centralized online cataloging system along with the newly used class number 155.6422 to enable searchers to browse Lists of Topics in the call number and subject outline searches and find the newly entered bibliographic record. In a library's online catalog, only subject-rich fields of classification authority records need to be maintained because the library staff can consult the centralized system for full classification information. Thus, there are two authority record types for classification records, one for the centralized online cataloging system and one for the local online catalog.

A standard machine-readable format is necessary for classification authority records for centralized online cataloging systems and local online catalogs. Forest Press, Decimal Classification Division, and Inforonics have already done much work in the formulation of a standard for classification records in their development of an automated editorial support system for use in the Division and production of Schedule records and Relative Index entries for use in the DDC Online Project (see appendixes A and B for Schedule records; appendix C for Relative Index records). Classification authority records for Schedule and Table class numbers in a centralized online cataloging system will contain subject-rich fields and those specific to classification tasks (see appendixes A, B, and C) and the contents of the *Manual on the Use of the Dewey Decimal Classification*. If Relative Index entries can be attached to the Schedule or Table record to which they refer, then there would be machine-readable classification authority records for the DDC Schedules and Tables, and miscellaneous classification authority records for Relative Index entries that refer to built numbers and for certain *Manual* entries (Comaromi and Warren 1982). Since these Relative Index entries refer to built numbers, selection of these entries during an alphabetical search would direct users to bibliographic records bearing these built numbers in a shelflist browsing of brief title records (instead of a List of Topics). Cochrane and Markey (1985) suggested that the fields and field coding enlisted for the DDC could also be applied to the Library of Congress classification.

With the help and experience of Forest Press and the Decimal Classification Division, the DDC Online Project has already done much work in the formulation of a standard machine-readable format for classification authority records for the Schedules and Relative Index entries in a library's online catalog. Schedule records in DOC contained the fields listed in table 1 with the addition of Relative Index entries. These classification authority records for a library's online catalog could also contain fields for local catalog information, such as the first-listed subject headings in bibliographic records bearing the same base class number as the Schedule record. Thus, fields in a classification authority record for a Schedule class number in an online catalog would contain the following fields:

1.	me	(DDC class number in the Schedules)
2.	met	(DDC Schedule caption)
3.	nex	(example note)
4.	nin	(including note)
5.	nch	(class here note)
6.	not	(general note)
7.	nop	(optional provisions note)
8.	nsx	(standard subdivisions exceptions note)
9.	ndn	(discontinued numbers and topics note)
10.	nrl	(relocation note)
11.	srf	(source of Schedule record)
12.	dri	(DDC Relative Index entry)
13.	sh	(local subject headings from the library's bibliographic records--optional if classification authority records for Table class numbers are included in the local online catalog)

The integration of the library classification and controlled vocabulary in a centralized online cataloging system will make the tools of the subject cataloger available in one *online* source. Not only will library staff be able to search and display authority records for the classification and controlled vocabulary, but they will have the classification practice of libraries expressed in millions of bibliographic records at their fingertips, so to speak. And they can obtain classification and subject heading data from the online cataloging system's authority records to enhance local bibliographic records and add to the indexes and displays of the library's online catalog. A library's local online catalog can be enhanced with subject searching capabilities for the classification and controlled vocabulary for access by both library staff and patrons. In the local online catalog, library staff can check their own library's classification practice by searching the catalog's database through subject searching capabilities such as the ones described herein.

9.6 First Steps toward Integrating the DDC into an Online Catalog

The capabilities of the redesigned experimental online catalog described in section 9.5.2 handled the three sources of subject information for a library's collection: (1) bibliographic records, (2) controlled vocabulary, and (3) library classification. We envision future online catalogs that will be able to manipulate these three sources of subject information in capabilities just like or comparable to the ones described. We do not expect that all these capabilities will be instantaneously built into new online catalogs or incorporated into the capabilities of existing catalogs. Rather, these capabilities will be gradually introduced into online catalogs for one or more reasons: (1) availability of authority data for subject headings and/or library classifications, (2) enhancement of the MARC format with a coding scheme for classification number fields in bibliographic records, (3) existing priorities of online catalog designers, (4) hardware and software costs of implementing the various capabilities into the online catalog, and (5) cost constraints of libraries involved with acquisition of new hardware or software. With these reasons in mind, recommendations are made for introducing a library classification into the subject searching features of online catalogs.

1. Encode the classification number fields of bibliographic records with a subfield coding scheme that identifies the source of the individual segments of class numbers from the Schedules and Tables of the library classification.

   Such a coding scheme will enable the entire library classification--not merely the index and schedules--to be integrated into the subject searching features of an online catalog. The coding scheme outlined by Wajenberg (1983) was discussed in section 9.5.1 and suggested as a starting point in the creation, testing, and implementation of a coding scheme for classification number fields in bibliographic records.

2. Build the library classification into a tool for subject access, browsing, and display in an online catalog for use by library patrons and reference staff.

   The library classification is a major source of unique subject-rich terms that enhance subject access to bibliographic records. It provides new strategies for subject searching and browsing that are not possible through the alphabetical approaches of subject headings and keywords presently supported by online catalogs. The library classification enhances the display of subject-rich information in bibliographic records and in displays of the bookshelf areas where retrieved items are located.

   Table 83 lists the sizes in number of bytes for the indexes of the various subject searches in SOC and DOC and in the experimental online catalog as a whole. In SOC at NYSL, PLCFC, and UI, the direct search index was the largest index of SOC's three subject indexes; only at LC was the alphabetical search index (which was made up of subject headings from bibliographic records) larger than the direct search index in SOC. In DOC at all four libraries, the direct search index was more than 75% of the entire database. Comparing the size of the direct search index with the sizes of the three other search indexes, we find the latter indexes much smaller. Online catalog designers concerned with the sizes of searchable indexes in an online catalog enhanced with the DDC are advised to first implement the alphabetical, subject outline, and class number searches.

   a. Alphabetical Searching. Integrate the Relative Index entries into the alphabetical displays of subject headings from bibliographic records and allow the searcher to select a listed Relative Index entry: (1) to display bibliographic records bearing the same class number as the entry or (2) to obtain a List of Topics constructed around the class number of the entry. This scenario of alphabetical searching is the same as that in the Dewey Online Catalog (section 5.3.1 and 5.5.2.1) except that subject headings and Relative Index entries are included in the same alphabetical display. The searcher's selection of a subject heading from the alphabetical display only leads to the display of bibliographic records containing the selected heading (sections 5.2.1 and 5.5.1.1).

Integrating subject headings and Relative Index entries into a single display takes advantage of the strengths of these two controlled vocabularies. Subject headings and their subdivisions describe specific subjects of books. Relative Index entries direct searchers to a single bookshelf location for books on a general topic.

Table 83. Sizes in Bytes of Searchable Indexes in the Experimental Online Catalog

	LC Number of Bytes	LC %File	NYSL Number of Bytes	NYSL %File	PLCFC Number of Bytes	PLCFC %File	UI Number of Bytes	UI %File
1. SOC								
a. Alphabetical search index	786,278	45	197,131	34	159,046	33	85,274	18
b. Direct search index	512,528	26	325,813	55	238,726	50	344,855	74
c. Call number search index	461,559	29	63,666	11	81,537	17	35,028	8
Total	1,760,365	100%	586,610	100%	479,309	100%	465,157	100%
2. DOC								
a. Alphabetical search index	100,058	9	33,222	6	42,771	9	67,934	12
b. Linkage of class number to Relative Index entry (UI only)	NA	NA	NA	NA	NA	NA	3,040	1
c. Subject outline search index	113,270	10	41,591	7	50,861	10	11,649	2*
d. Direct search index	913,309	79	464,408	86	394,916	79	478,996	84
e. Call number search index	24,455	2	2,579	1	10,406	2	3,776	1
Total	1,151,092	100%	541,800	100%	498,954	100%	565,395	100%
2. Experimental Online Catalog								
a. SOC/alphabetical search index	786,278	33	197,131	24	159,046	22	85,274	12
b. DOC/alphabetical search index	100,058	4	33,222	4	42,771	6	67,934	10
c. DOC/linkage of class number to Relative Index entry (UI only)	NA	NA	NA	NA	NA	NA	3,040	1
d. Subject outline search index	113,270	5	41,591	5	50,861	7	11,649	2
e. Direct search index	913,309	38	464,408	58	394,916	53	478,996	69
f. SOC/call number search index	461,559	19	63,666	8	81,537	11	35,028	5
g. DOC/call number search index	24,455	1	2,579	1	10,406	1	3,776	1
Total	2,398,929	100%	802,597	100%	739,537	100%	685,697	100%

*First-listed subject heading in UI bibliographic records were not included in the subject outline index (see section 5.6.5, item 1).

Libraries whose bibliographic records do not bear subject headings need an alphabetical search in their online catalog to handle Relative Index entries. Their alphabetical search will resemble DOC's alphabetical search (sections 5.3.1 and 5.5.2.1); it will suffer the same drawbacks as DOC's alphabetical search which searchers criticized for the lack of specificity in listed entries and the items retrieved by the selection of an entry (sections 8.5.3 and 8.5.5).

b. Class number searching. When the user-entered class number matches a synthesized class number, provide a shelflist browsing capability. When the user-entered class number matches a Schedules or Table class number, construct a List of Topics around the user-entered class number. This scenario of class number searching is the same as that described in the redesign of the experimental online catalog (section 9.5.2.1).

In class number searching, the searcher usually enters a class number that he has previously identified as relevant through a previous subject search and found listed in a retrieved bibliographic record. Such class numbers could be synthesized numbers or numbers enumerated in the DDC Schedules. Thus, the online catalog has to be equipped to respond to both types of class numbers. Online catalogs for libraries whose bibliographic records do not bear subject headings will be equipped with the same class number searching capabilities as those for libraries whose bibliographic records bear subject headings.

c. Subject outline searching. Build a subject outline search into an online catalog that enables the searcher to match his entered term with the keywords in the library classification schedule and index and the first-listed subject headings in bibliographic records (when classification number fields have not been coded so as to automatically identify the source of the Schedules and Table class numbers in bibliographic records) or with the keywords in the library classification schedule, index, and tables (when classification number fields have been coded) to find the bookshelf locations where there are items on his entered term. The searching procedures recommended for subject outline searches are described in section 9.5.2.4 and include the following:

- Provide a limit by date, language, another subject search, or another criterion when the results of this search are highly posted.

- Enhance the display of retrieved items so that the first items displayed in subject outline searches are those that would be retrieved in a direct search for the user-entered term.

The subject outline search index in online catalogs for libraries whose bibliographic records bear no subject headings will only contain keywords from the library classification. These libraries would especially benefit from a coding scheme for classification number fields in bibliographic records; then the keywords from classification tables could be entered into the subject outline search.

d. Enhancing bibliographic records with the classification. The three subject searching capabilities just described do not necessarily require the enhancement of bibliographic records with subject-rich terms from the library classification.

These subject-rich terms from the classification can be stored separately with their links to bibliographic records. Table 84 lists the numbers of kilobytes (Kbytes) used in the experimental online catalog's indexes when the DDC is kept in indexes separate from bibliographic records and when the DDC is kept in indexes and in bibliographic records. The differences between the numbers of bytes used to store the DDC in the two cases demonstrate that storage requirements drop dramatically when the DDC is only stored in searchable indexes.

In DOC, captions from the Schedules were the only DDC information displayed in bibliographic records even though these records were enhanced with DDC Schedule notes and Relative Index entries. We feel that these captions should be displayed in bibliographic records, particularly in records without subject headings. Schedule notes and Relative Index entries do not need to be displayed in or added to bibliographic records (for the reasons given in section 5.6.3). When classification numbers are coded as to their sources in the Schedules and Tables, Table captions should also be displayed in bibliographic records. Table notes only need to be stored in the online catalog's searchable indexes with their links to bibliographic records.

Table 84. Number of Kilobytes (Kbytes) Used to Store the DDC

	Number of Kbytes used to store the DDC in indexes separate from bibliographic records:			
	LC	NYSL	PLCFC	UI
DDC Relative Index	353	27	107	46
DDC Schedules	186	28	57	64
Total	539	55	164	110
	Number of Kbytes used to store the DDC in indexes and in bibliographic records:			
	LC	NYSL	PLCFC	UI
DDC Relative Index	992	419	351	683
DDC Schedules	928	355	354	352
Total	1,920	774	705	1,035

e. Modifying the results of alphabetical, subject outline, and class number searches. Subject outline searchers were particularly vocal about the need to limit or modify the results of their searches (section 8.4.7), and searchers who performed other types of subject searches also expressed the need for an online catalog capability to limit search results (section 8.7.3). The direct search is costly in terms of online storage space (table 83) and may not be implemented right away in an online catalog enhanced with a library classification. Thus, the direct search would not be used to limit the results of an online catalog search (see fig. 53, section 9.5.2.1). Other searches that would be available for limiting searches are alphabetical, subject outline, and call number searches. Search results could also be limited by criteria such as publication date, language, and format. However, searchers would have to be reminded that they can limit search results through the listing of an option to limit results or a suggestive prompt or menu following the creation of a highly posted set.

3. Enhance the library classification with captions and index entries that are understandable to library patrons and express the specific subject matter of items bearing associated class numbers.

In sections 8.4.4 and 8.4.7, we showed subject outline searches that directed searchers to a List of Topics whose captions were not readily understandable to them and/or did not express the subject contents of a book bearing a particular caption. The analysis of DDC information in section 9.3 further demonstrated that not all DDC information added to bibliographic records was a satisfactory indicator of a book's subject contents.

In Lists of Topics and Lists of Perspectives accessed by online catalog users, the wording of captions must be understandable and indicative of the subject matter of items bearing a particular class number and caption. Otherwise, patrons will not follow up intermediate search results by selecting a listed perspective or topic during their online search. Captions that especially need to express the subject matter of books in a class area are those associated with three-digit class numbers because these captions are used in the List of Perspectives to convey the general subject of the classification area where there are items bearing the user-entered term. The wording of dummy captions which were used to construct Lists of Topics for class numbers with trailing zeros needs to be changed and pretested with other online catalog users to ensure its understandability. The wording of individual captions in expanded ranges of class numbers was all the same in the experimental online catalog. This wording needs to be changed so that each caption's wording is unique and reflects the specific subject matter of items with the particular class number. Captions with contrived or confusing wording such as "Standard subdivisions" and "Inflated ball thrown or hit by hand" and with negative words or phrases such as "other than" need to be changed and pretested with online catalog users.

DDC Relative Index entries would be much more understandable to library patrons and easier for them to match in alphabetical searches by replacing hyphens in adjacent words that make up a logical phrase with spaces. Adding more specific entries to the Relative Index, particularly for topics listed in the Schedule that do not have Relative Index entries, is also recommended.

4. Improve centralized online cataloging systems with a classification authority function that enables library staff to search the files of classification authority records and bibliographic records and to automatically assign classification authority information to bibliographic records and the local online catalog.

   In section 9.4, the needs of library staff performing classification tasks for an online catalog were featured. The capabilities for a classification authority function for centralized online cataloging were described in section 9.5.3. The necessary capabilities that a classification authority function must provide in an online cataloging system are listed below.

   a. Maintenance of the most up-to-date version of the classification and announcement of new, relocated, changed, or discontinued numbers to library staff

   b. Online searching and display of classification authority records through a variety of approaches such as alphabetical, direct (keyword), and class number searching

c. Display of all Schedule and Table notes associated with a class number. The inclusion of *Manual* notes (Comaromi and Warren 1982) should also be considered

d. Automatic assignment of classification authority data to bibliographic records and to the library's own online catalog

e. Online subject searching and display of bibliographic records in the cataloging database through a variety of approaches such as alphabetical, subject outline, and class number searching

The Dewey Decimal Classification Online Project has demonstrated that the DDC enhances subject access to libraries' bibliographic records (section 9.3). It also provides new and fruitful subject searching capabilities that are not possible through the alphabetical and keyword searching permitted by existing online catalogs (chapters 7 and 8). The DDC also enhances the display of subject-rich information in bibliographic records and in displays of the bookshelf areas where retrieved items in online searches are located. Thus, the DDC enhances subject access to bibliographic records, subject searching strategies in online catalogs, and the display of bibliographic information.

In online retrieval tests, we evaluated the subject searching capabilities of an experimental online catalog that had been enhanced with the DDC. Library patrons and staff were enlisted in these tests and provided their comments on the catalog's ease of use and suggested ways in which the catalog and its capabilities could be improved (chapters 7 and 8). Library staff performing classification tasks in the Decimal Classification Division of the Library of Congress expressed their needs for online searching and display capabilities in an online catalog and online cataloging system (section 9.4). Based on library patron and staff suggestions and our experiences searching the experimental online catalog, capabilities for an online cataloging system and a redesigned experimental online catalog were described in which the three sources of subject-rich information about a library's collection are integrated: (1) bibliographic records, (2) library classification, and (3) controlled vocabulary used by the library (section 9.5). We recommended capabilities for an online cataloging system and redesigned experimental online catalog enhanced with the DDC without regard to cost or the limitations of a particular computer system (sections 9.5.2 and 9.5.3). We tempered these recommendations with a description of the necessary capabilities for an online cataloging system and online catalog to handle the DDC for use by library staff performing classification tasks and library patrons performing subject searches (section 9.6).

The research conducted in the DDC Online Project increased our understanding of subject searchers' use of library classification in an online information retrieval environment. It provided insight into searchers' problems with online displays of the DDC hierarchy, online bibliographic record displays, and manipulation of online displays, all of which will help system designers in future implementations of the DDC online. The research also produced data and analyses on the use of online catalogs by library patrons and staff. The experimental online catalog was the first implementation of a library classification as a tool for subject access, browsing, and display in an information retrieval system accessed by *end users* of libraries. The catalog was also tested by these end users in retrieval experiments; their comments about the catalog's strengths and weaknesses were offered as recommendations for improvement and enhancement of the experimental online catalog to ensure that future implementations of the DDC in online catalogs meet with the acceptance and satisfaction of library patrons.

Appendix A. Definitions of and Fields in DDC Schedule Records

TAG	TAG NAME	DESCRIPTION	EXAMPLE(S)
me	main entry	The classification number or number range that the rest of the record describes.	me 200.14 me 220.05$.08
met	main entry text	The verbal description of the meaning of the last significant digit(s) of the classification number in the _me_ tag.	me 200.71 met Schools and courses (This is a verbal description of the meaning of the digit "1" only. Other records contain the meaning of the 200.7 and 200 portions.)
ch	centered heading	The classification number range that introduces some general remarks about some main entries treated as a group.	ch 200.4$200.5
cht	centered heading text	The verbal description of the meaning of the last significant digit(s) of the centered heading in the _ch_ tag.	ch 220.1$220.9 cht General principles
smh	summary heading	The field that identifies the record as a summary record.	smh SUMMARY
smn	summary number	Each of the classification number-text items in a summary record. The textual portion is separated from the numeric portion by a subfield delimiter @t.	smn 220.1@tOrigins and authenticity

Appendix A--Continued

TAG	TAG NAME	DESCRIPTION	EXAMPLE(S)
n	notes	Comments on the main entry, centered heading, or text that accompanies the main entry or centered heading. There are over twenty individually tagged note types. A description of these is given in appendix B. (See explanation below of note subfielding.)	nrl @rClass in 220.4$220.5 nce @rClass comprehensive works in 220
srf	schedule record from full edition indicator	One of the system-supplied tags designed to indicate from which section of the Dewey classification the record comes.	srf Schedule-Full Ed. Other similar tags for other portions of the classification: sra Schedule-Abridged Ed. trf Table-Full Ed. tra Table-Abridged Ed. irf Index-Full Ed. ira Index-Abridged Ed.
rno	record number	The number assigned to each record as it enters the database. The first digit is the same as the first digit of the me, ch, or numeric portion of the smn. The next five digits are sequence digits from 00001 on. The last two digits are always zeros in the initial conversion of the database to allow room for later interpolation of records. Inforonics originally thought that this relatively simple, somewhat truncatable number would serve some use in searching, but no such use has been readily apparent in testing conducted thus far.	rno 20014500
isq	index sequential number	The control number that will govern record deletion and replacement in editorial processing. This number, which is system-supplied, is structured as follows:	isq 830803211701465

Appendix A--Continued

Digits 1-6 :	Date entered into system (in yymmdd format)
Digits 7-10 :	Time entered into system (in hhmm format, based on twenty-four hour clock)
Digits 11-14:	Sequence number for records entered at same date and time
Digit 15 :	Mod-9 check digit

Comment on Note Subfielding

Each Schedule note begins with a subfield delimiter that indicates the typographic level at which the note sits. The following are legal values:

@r - Regular indention level
@m - Relative main entry indention level
@n - Note within Relative main entry indention level
@c - Cross-reference note within Relative main entry indention level
@x - Regular cross-reference note indention level
@t - Option table note indention level

Within precedence table notes, there is usually a textual portion and a numeric portion, with the textual portion appearing first in the note. When this is the case, the numeric portion is separated from the textual portion by a @d.

Example:

```
not     Divinely inspired persons@d291.63
```

Appendix B. Explanations of Schedule Notes

1. In the column entitled "Distinctive Strings" is listed the distinctive text in a note or beginning a note that enabled Inforonics to automatically identify the note in the machine-readable DDC Schedules and tag the text of the note with the appropriate tag or field label.

2. In each of the distinctive strings given below, the presence or absence of uppercase letters is significant to the string classification. If the uppercase distinction is not significant, the letter is enclosed in parentheses.

NOTE TYPE	TAG	DISTINCTIVE STRINGS	COMMENTS
1. new Schedule notes	nsn	completely new	
2. Phoenix Schedule notes	npx	completely new *and* italicized	
3. example notes	nex	Examples: *or* Example:	
4. former heading notes	nph	Former heading:	
5. including notes	nin	Including	
6. class here notes	nch	Class here	
7. alphabetic arrangement notes	nlp	Arrange alphabetically	
8. optional provisions notes	nop	(I)f preferred *or* (I)f it is desired *or* (O)ptional *or* may be used	In 20th edition, all option notes will be in parentheses.
9. standard subdivisions Table notes	nst	Notations from Table	
10. standard subdivisions exceptions notes	nsx	Do not use *or* do not add "Standard"	

Appendix B--Continued

NOTE TYPE	TAG	DISTINCTIVE STRINGS	COMMENTS
11. use of more than one zero for standard subdivisions notes	nsz	for standard subdivisions	
12. add notes	nad	(A)dd or extended meanings	
13. citation notes	nco	Unless other instructions are given or priority in notation or table of precedence or unless otherwise instructed	
14. discontinued numbers and topics notes	ndn	discontinued	
15. relocation notes	nrl	formerly and Class or Class and [before class. no.	
16. most recent use notes	nru	Most recently used in	
17. class elsewhere notes	nce	Class	
18. cross-reference notes	ncr	[Tagged as 5x in A.D. Little database]	
19. introduction to Table notes	nit	[Tagged as 26, 27, or 28 in A. D. Little database]	
20. other types of notes	not	---	Includes scope notes, definition notes, general concept notes.
21. see also notes	nsa	(S)ee also	New type of note for 20th edition.

Appendix B--Continued

NOTE TYPE	TAG	DISTINCTIVE STRINGS	COMMENTS
22. ---	nrx	---	This set of subindexes will access all notes which contain the word "formerly" in italics implying that the scope of a classification number has changed from what it was in a previous edition.
23. ---	nmt	---	This set of numeric subindexes will access the numbers in the text explaining the classification number which are preceded by the word "formerly."
FOOTNOTES			
1. add as instructed under footnotes	nfa	as instructed	
2. class as instructed under footnotes	nfc	as instructed under and Class	
3. option footnotes	nfo	is optional and prefer	
4. use of more than one zero in standard subdivisions footnotes	nfz	Use and 0	
5. other types of footnotes	nfx	---	

Appendix C. Definitions of and Fields in DDC Relative Index Records

TAG	TAG NAME	DESCRIPTION	EXAMPLE(S)
ixa	index text (1st level)	The textual description of the index entry broken into hierarchical levels as it appears in the printed 19th edition. These were originally in one long subfielded field, but the Decimal Classification Office requested this format.	ixaNew
ixb	index text (2nd level)		ixbYork
ixc	index text (3rd level)		ixcCity
ixd	index text (4th level)		
ixe	index text (5th level)		
ixf	index text (6th level)		
ixg	index text (7th level)		
ixh	index text (8th level)		
ixn	numeric reference for index text	The Schedule or Table number to which the index text refers.	ixn332.113
ixr	cross reference from index text	The point within the Index to which the index text refers.	See below
xxx	sort point	The processed version of the portion of field ixr which caused the record to be included in the portion of the database which was selected for inclusion in the OCLC project. It should duplicate one of the numbers contained in field ixr.	ixr See spec. kinds of programs e.g., employment programs 331.133 xxx331.133
rno	record number	The number assigned to each record as it enters the database.	rno 104482

Appendix C--Continued

TAG	TAG NAME	DESCRIPTION	EXAMPLE(S)
isq	index sequential number	The control number which will govern record deletion and replacement in editorial processing. This number, which is system-supplied, is structured as follows: Digits 1-6: Date entered into system (in yymmdd format). Digits 7-10: Time entered into system (in hhmm format, based on 24 hour clock). Digits 11-14: Sequence number for records entered at same date and time. Digit 15: Mod-9 check digit.	isq 840413020313324
irf	index record from full edition indicator	One of the system-supplied tags designed to indicate from which section of the Dewey Classification the record comes.	irf Index-Full ed.

NOTE:

There are no subfields within Index records.

Appendix D. Definitions of Subject Online Catalog (SOC) Options

SOC options are defined and presented in alphabetical order. To find out when an option can be entered in a SOC search, consult the SOC option menus in figure 13. To find out the bibliographic record fields whose contents are indexed for the three SOC subject searches, consult table 5.

BB Browse backward in this alphabetical list
SOC displays a list of ten subject headings in a List of Aspects that are alphabetically above the list of ten headings currently displayed. The last line in the List of Aspects is identical to the first line in the previous list to provide continuity from one list to the next.

BF Browse forward in this alphabetical list
SOC displays a list of ten subject headings in a List of Aspects that are alphabetically below the list of ten headings currently displayed. The first line in the List of Aspects is identical to the last line in the previous list to provide continuity from one list to the next.

DI Display items
SOC displays the set of items chosen by the user from the Summary of Searches currently on the screen. The items are displayed individually in increasing order of library DDC class numbers until the user stops the display by responding "no" to the question "Would you like to see the next item?" at the end of each displayed item. The sets in the Summary of Searches are created and saved throughout the search session using the SD option in the direct search, the SC option in the call number search, or the SL option in the alphabetical search during the browsing of the List of Aspects.

ES End search
SOC ends the search session.

RS Review your searches
SOC displays the Summary of Searches for the ten most recent sets.

SA Search alphabetically for subject
SOC performs an alphabetical search based on the user-entered term and displays a list of ten subject headings in a List of Aspects. This List of Aspects either displays the user-entered term on the third line (if the subject was found) with an asterisk (*) to direct the searcher's attention to this line, or displays the best match of the user-entered term on the third line (if the subject was not found).

Appendix D--Continued

SC Search for call number
SOC creates and saves a set of items matching the user-entered call number, then displays the Summary of Searches which includes the number of items found and saved in this new set.

SD Search directly for subject
SOC creates and saves a set of items matching the user-entered term through an implicit and Boolean keyword search (using the AND operator). SOC displays intermediate results, and when displaying the final result, SOC displays the Summary of Searches, which includes the number of items found and saved in this new set.

SL Select line(s) to display items
SOC displays the set of items chosen by the user from one or more subject headings in the List of Aspects. The items are displayed individually in increasing order of library DDC class numbers until the user stops the display by responding "no" to the question "Would you like to see the next item?" at the end of each displayed item. Then, SOC displays the last List of Aspects viewed by the user.

SO Start over
SOC allows the user to enter a search statement by displaying the three subject search options or allows the user to display items saved in previously created sets.

Appendix E. Stopwords in SOC and DOC

a
about
above
after
ahora
al
all
also
an
and
antes
approx
are
arriba
as
at
au
aux
avec
based
before
bei
below
both
by
circa
como
concerning
de
des
despues
dlya
du
ein
eine
en
eres
es
esta
estas
et
etc
examples
for
from
how
if
ili
in
including
ine
into
is
it
iz
kogda
la
le
les
na
ni
nicht
no
noch
nor
not
now
ob
oder
of
off
on
or
ot
out
over
para
por
pri
radi
see
since
so
takzhe
that
the
these
those
though
through
thru
till
to
toward
towards
tozha
um
un
una
und
under
until
up
upon
von
was
were
when
where
whether
which
while
with
within
without
yet
za

Subject searches employing this list are the direct search (SD) in SOC and DOC and subject outline search (SS) in DOC.

Appendix F. Definitions of Dewey Online Catalog (DOC) Options

DOC options are defined and presented in alphabetical order. To find out when a defined option can be entered in a DOC search, consult the DOC option menus in figure 20. To find out the bibliographic record fields whose contents are indexed for the four DOC subject searches, consult table 6.

BB Browse backward in this alphabetical list
DOC displays a list of ten entries from the DDC Relative Index in a List of Aspects. These ten entries are alphabetically above the list of ten entries currently displayed. The last line in the List of Aspects is identical to the first line in the previous list to provide continuity.

BF Browse forward in this alphabetical list
DOC displays a list of ten entries from the DDC Relative Index in a List of Aspects. These ten entries are alphabetically below the list of ten entries currently displayed. The first line in the List of Aspects is identical to the last line in the previous list to provide continuity.

BG Browse more general topics
DOC displays one level of the DDC Schedules in a List of Topics that is one level above the previous list; that is, the DDC class numbers are exactly the same except they are one digit shorter than those in the previous list. The most general level in DOC is the level bearing three-digit DDC numbers.

BP Browse a perspective
DOC presents a List of Perspectives that are captions from the DDC Schedules at the most general level in DOC (i.e., the level bearing three-digit DDC numbers) to provide the searcher with a general idea of the DDC classification areas whose bibliographic records bear the user-entered terms.

BS Browse more specific topics
DOC displays one level of the DDC Schedules in a List of Topics that is one level below the topic selected by the user to trigger the display; that is, the DDC numbers displayed here are exactly the same except they are one digit longer than those in the previous list. The most specific level is the last level that exists in the printed DDC Schedules.

Appendix F--Continued

DI Display items
DOC displays the set of items chosen by the user from the Summary of Searches currently on the screen. The items are displayed individually in increasing order of the Schedules DDC class numbers until the user stops the display by responding "no" to the question "Would you like to see the next item?" at the end of each displayed item. The sets in the Summary of Searches have been created and saved throughout the search session using the SD option in the direct search, SL option in the alphabetical search during the browsing of the List of Aspects, or SL option in the call number and subject outline searches during the browsing of the List of Topics.

ES End search
DOC ends the search session.

GN Get detailed notes for a topic
DOC displays additional information about a topic chosen from the List of Topics. The information displayed here includes the entire DDC caption (which may have been truncated to fit in the List of Topics), DDC Schedule notes, and the DDC Relative Index entries. DDC notes include example notes, including notes, class here notes, optional provision notes, standard subdivisions exceptions notes, discontinued numbers and topics notes, relocation notes, and other types of notes. After this display is completed, DOC displays the last List of Topics viewed by the user.

RP Return to perspectives list
DOC returns the user to the List of Perspectives after browsing a List of Topics.

RS Review your searches
DOC displays the Summary of Searches for the ten most recent sets.

SA Search alphabetically for subject
DOC performs an alphabetical search based on the user-entered term and displays a list of ten DDC Relative Index entries in a List of Aspects. This List of Aspects either displays the user-entered term on the third line (if the subject was found) with an asterisk (*) to direct the searcher's attention to this line, or displays the best match of the user-entered term on the third line (if the entry was not found).

SC Search for call number
DOC displays one level of the DDC Schedules in a List of Topics that includes the user-entered DDC class number.

SD Search directly for subject
DOC creates and saves a set of items matching the user-entered term through an implicit and Boolean keyword search (using the AND operator). SOC displays intermediate results, and when displaying the final results, DOC displays the Summary of Searches, which includes the number of items found and saved in this new set.

Appendix F--Continued

SL Select line(s) to display items
The SL option is used in two different occasions in DOC: during the browsing of the List of Aspects and during the browsing of the List of Topics. In either case, DOC displays the set of items chosen by the user from one or more entries in the List of Aspects or one or more Schedule captions in the List of Topics. The items are displayed individually in increasing order of Schedules DDC class numbers until the user stops the display by responding "no" to the question "Would you like to see the next item?" at the end of each displayed item. Then, DOC displays the last List of Aspects or List of Topics viewed by the user.

SO Start over
DOC allows the user to enter a search statement by displaying the four subject search options or allows the user to display items saved in previously created sets.

SS Search subject outline for subject
DOC performs an implicit and Boolean keyword search (using the AND operator) on the user-entered term and directs the user to one class number area (through a List of Topics) or more than one class number areas (through a List of Perspectives) where there are bibliographic records whose DDC Schedule caption, notes, Relative Index entries, or first listed subject heading contains the user-entered term.

ST Search subject outline for a topic from the list
DOC displays the List of Topics to which the selected DDC Relative Index entry points after the user selects the DDC Relative Index entry from the List of Aspects.

Appendix G. Expert Review Recommendations of the Experimental Online Catalog

Operational Capabilities	System(s) Affected	Action taken/Reason
1. Provide a command-driven interface	Both	None. In the retrieval tests, the library patron or staff member would be using SOC or DOC for the first time. Thus, we felt a menu-driven interface was more appropriate for first-time users.
2. Provide a "recovery" mechanism in case the user entered something he did not mean to enter.	Both	Compromise. When the user chooses a subject search option that he did not intend to choose and presses the RETURN key twice, he cancels his request.
3. Do not ask the user to select a line if there is only one line listed.	Both	Done.
4. If the user has entered the option name and line letter on the same line, the system should not ask the user to enter the line letter.	Both	Done.
5. Ability to go from the DDC Schedules back to the DDC Relative Index.	DOC	None. The four databases created in the DDC Online Project were restricted to one or two subject areas. There were few Relative Index entries bearing a main entry and one or two secondary entries that matched segments of another Relative Index entry. DOC searchers rarely needed to select more than one entry to display items or to be

Appendix G--Continued

		directed to outlines of Schedule captions. When the entire Relative Index is available in an online catalog, there will be more Relative Index entries bearing a main entry and one or two secondary entries that match segments of other Relative Index entries. Thus, the ability to maneuver from the Relative Index to the Schedules and back to the Relative Index will increase in importance.
6. Entry of end search (ES) option anytime during the search.	Both	None. The end search (ES) option is only meant to be used at the end of a DOC or SOC search session. The maximum number of steps needed to end the session are two steps (start over, end search).

Operational Capabilities	System(s) Affected	Action taken/Reason
1. Boolean operations	Both	None. These functions were developed and tested but were deleted because of lack of coding space in LSI-11 microcomputer.
2. Ability for user to remain in the same type of subject search even though no items were retrieved using the particular type of subject search.	Both	None. Both SOC and DOC are designed to encourage searchers to reenter their search terms using a different subject search option and not necessarily different search terms.
3. Ability for the system to automatically reenter the user-entered term using a different subject search type after the one selected by the user fails to retrieve items.	Both	Compromise. The user should be able to view the results of a subject search just in case the information displayed, e.g., List of Aspects, contains information that could direct the user to

Appendix G--Continued

relevant items. Options menu contains other subject searches which the user can select to reenter a search for the same topic.

4. Include other types of subject searches in the options menu following the alphabetical search.	Both	Done.
5. After the user selects a line from the List of Aspects to display items, the system should enter the terms in the selected line into a subject outline search or direct search instead of the user-entered term.	Both	Compromise. In DOC, the ST (search subject outline for a listed topic) option allows the user to select a listed Relative Index entry followed by a variation of the subject outline search. SOC and DOC are designed to encourage searchers to reenter their search terms using a different subject search option and not necessarily different search terms.

Display and Output Control Capabilities	System(s) Affected	Action taken/Reason
1. Alternatives to the display of Relative Index entries in bibliographic records should be sought.	DOC	Compromise. Relative Index entries were not displayed in bibliographic records or in a separate display before bibliographic records. Relative Index entries were displayed in a display of captions and subject-rich notes from the DDC Schedules.
2. Include edition statement in displays of bibliographic records.	Both	Done.
3. Alter the order of fields in bibliographic records so that author, publisher, and series are sandwiched between call number and title and subject information.	Both	None. Subject-rich fields of bibliographic records were listed before other fields, such as publisher and author in SOC and DOC, which only featured subject searches.

Appendix G--Continued

4.	When the display of the Schedule notes and Relative Index entries contains none of these optional field contents, DOC should inform the user that there is no additional information in the Schedules and Relative Index for the selected topic.	DOC	None. There is no quick way to know in advance when a DDC Schedule caption contains no Schedule notes and does not exceed sixty characters (which is the maximum length of a DDC Schedule caption displayed in the List of Topics) and contains no Relative Index entries. Given increased coding space, this could be done.
5.	When a user selects an aspect from the List of Aspects and displays items, the original List of Aspects should be altered so that the selected aspect appears on line 3 the next time the List of Aspects is displayed.	Both	None. We felt that changing the line number on which the user-selected aspect appeared could be confusing to the user.
6.	Hyphens in DDC Relative Index entries look unnatural.	DOC	None. The indention in the printed *Relative Index* was automatically replaced by two hyphens between main and secondary Relative Index entries. Manual editing would have been necessary to distinguish between main and secondary entries that were a phrase and should be separated by one space.
7.	Browse forward and backward in the display of bibliographic records.	Both	Compromise. This capability required a lot of coding space to implement. Since a printer produced a hardcopy record of displayed items, users could consult the printout to view an item previously displayed, but they could not jump forward or backward in the display of items.

Appendix G--Continued

8. Display "long" and "short" bibliographic records.	Both	None. In the retrieval tests, we wanted users to see the same representation of bibliographic records (i.e., "long" or complete records) on which they were to base their relevance assessments.
9. Omit LC subject headings from bibliographic record displays because they are not included in browsing displays (List of Aspects) of Relative Index entries in DOC.	DOC	None. LC subject headings are still searchable in DOC using the subject outline (SS) and direct (SD) searches. LC subject headings were left out of DOC's List of Aspects because it would have been very difficult to separate the effect of Relative Index entries in the List of Aspects from the effect of LC subject headings (in the retrieval tests).
10. Allow user to enter a line letter followed by the option name to display items (SL).	Both	None. The entry of a line letter followed by option name was not consistent with the entry of other options and line letters.
11. Show the entire DDC hierarchy in a window to place that part of the hierarchy viewed by the user in the overall context of the DDC Schedules.	DOC	None. LSI-11 does not have a windowing or graphic capability. Given state-of-the-art hardware, this could be done.

User Assistance Capabilities	System(s) Affected	Action taken/Reason
1. Directional prompts that are potentially unclear to users:		
a. Enter options	Both	Compromise. Error message instructs user to select an option from list of options provided.
b. Press RETURN to continue	Both	Compromise. Changed to "Press RETURN to resume search"

Appendix G--Continued

c. Enter subject term or phrase	Both	Compromise. Changed to "Enter subject to search"
2. Wording of subject search options that are potentially unclear to users:		
a. Search alphabetically for subject	Both	None. Let the user select this option to see how it works.
b. Search directly for subject	Both	None. Let the user select this option to see how it works.
c. Search for call number	Both	None. Let the user select this option to see how it works. (Suggested option name "Search by classification for subject" was not used.)
3. Wording of option and option description that is potentially unclear to users:		
a. Change "browse topics" to "search subject outline for subject."	DOC	Done.
b. What does GI (get more information) option mean?	DOC	Compromise. Changed to GN (get detailed notes for a topic).
c. Change SL (select lines to display items) option to "Display item at location" or "Display titles."	Both	None. The existing option name SL (select lines to display items) was the most literal of all the alternatives for describing the user's action to display items.
4. Words or phrases in messages, options menus, or lists that are potentially unclear to users:		

Appendix G--Continued

a.	Explain "subject," "topic," and "perspective" on a card.	DOC	None. The menu-based mode of the system precluded the need for written instructions. We hoped users would pursue their searches and tell us their difficulties with such terminology.
b.	"Dewey subject" and "Dewey Index"	DOC	None. No alternative wording provided.
c.	What does asterisk (*) mean in left margin of aspects or topics lists?	Both	None. (It is meant to draw the user's attention to an explanatory system message and/or listed topic or aspect.)
d.	Why is the message "Your term was not found" occur in the middle of a List of Aspects?	Both	Compromise. (It occurs at the best match of the user-entered term in the alphabetically arranged List of Aspects.) When this message confused searchers in retrieval tests at the University of Illinois, we deleted the message.
e.	Change "display items" to "display items in a set."	Both	None. We felt that the former was adequate to describe the user's action and that the word "set" would not be known to users.
f.	Change "Review sets" to "Review your searches."	Both	Done.
g.	Change "Detailed Dewey notes" to "Detailed notes...."	DOC	Done.
h.	Use the same field labels in DOC Schedule record and bibliographic record displays.	DOC	Done.
i.	Change message when user selects ST option to read "Your topic is found under xxx.xx in this outline."	DOC	Compromise. The message is "Items on your subject are found under xxx.xx in this outline."

Appendix G--Continued

j. "Browse forward" and "Browse backward" can mean the opposite.	Both	None. Let the user select this option to see how it works.
k. The use of RETURN to stand for the "Yes" user response is inconsistent.	Both	Compromise. The only place where users enter RETURN is to display bibliographic records. The system accepts "y," "yes," or RETURN.
l. Messages containing "I" or "you" are too personal.	Both	Compromise. One message contains the word "you." None contain "I."
m. If a user stops displaying bibliographic records, do not make him have to enter RETURN.	Both	Done.
5. Words or phrases added to messages, options menu, or lists to clarify or enhance meaning of the message:		
a. When user's term is not found in a direct or alphabetical search, system should say "Your topic x was not found" (where x is the user-entered term).	Both	None. Although this is a good suggestion, this message would have required too much valuable coding space.
b. In options menu following alphabetical search, subject options should be changed from "search subject option for previous subject" or "search directly for previous subject" to "search subject outline for x" or "search directly for x" (where x is the user-entered term).	Both	Done.
c. Include topic selected in the message indicating how many items were retrieved in alphabetical or subject outline searches.	Both	Done.

Appendix G--Continued

d.	Tell the user what is happening when the List of Perspectives is created and how this List of Perspectives can help the user.	DOC	Compromise. Message preceding List of Perspectives is as follows: "Your subject is treated from n perspectives" (where n is the number of listed perspectives).
e.	Display "i of n" message preceding display of bibliographic records to tell user the total number of records retrieved (n) and the record (i) currently displayed.	Both	Done.
f.	Append valid option names to individually listed aspects or topics in their respective lists.	DOC	None. While this would have been helpful to users, it would have taken valuable coding space.
g.	Add DDC class number to "GENERAL TOPIC" heading in List of Topics.	DOC	Done.
h.	Conduct a survey to find the best names for fields in Schedule and bibliographic records and option names and descriptions.	Both	None. A survey would have taken too long to conduct given the time schedule of the project. We relied on experts' recommendations for renaming fields and options.
6.	Options menu should list direct search before alphabetical search.	Both	None. The design philosophy of the experimental online catalog encourages users to match the catalogs' controlled vocabulary in the alphabetical search before matching keywords in bibliographic records.
7.	Display of field names and field numbers are repetitive in Schedule and bibliographic record displays and make these displays too busy. List a field name once and delete all numbers.	Both	Done.

Appendix H. Comparison Search Refusal Tally Sheet

COMPARISON SEARCH
REFUSAL TALLY SHEET
(Completed by Interviewer)

1. Library: UI PLCFC NYSL LC
2. Date:____________________
3. Time Recruiting Began:__________
4. Time Recruiting Ended:__________
5. Recruiter's Initials: KM JT

Refusal Number	Reason: No Time	Known-Item Search	Wrong Subject Area	No Reason	Other (Describe)
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					

TOTAL
REFUSALS:

Appendix I. Comparison Search Experiment Interviewer Questionnaire

Questionnaire #_________________ Date:_______________________________

Library: UI PLCFC NYSL LC

First System: SOC DOC Interviewer: KM JT Gender: M F

A. Introduction.

Hello. I'm ______________ from the OCLC Online Computer Library Center in Dublin, Ohio, a not-for-profit computer service and research organization for libraries. We are conducting a study to find out how well this online catalog helps you find what you are looking for. We would like you to participate in our study. In return, you will receive a hardcopy print of your search results.

B. Demographic questions.

1. For what topic will you be looking when searching the online catalog? (Interviewer: If this is known-item search or a search for a subject which is not in ___________, terminate interview now by telling patron that catalogs can only accommodate subject searches in the area of __________.)

2. The purpose of your online catalog search is for:

_____ Class or course-related purposes
_____ Personal interest
_____ Advanced research
_____ Job-related purposes

3. How many times have you used this online catalog, i.e., the one used for this experiment?

_____ Never before
_____ 1 time
_____ 2 times
_____ 3 times or more

Appendix I--Continued

4. (Only at UI, NYSL, LC) Do you use the library's computer catalog:

_____ Daily
_____ Weekly
_____ Monthly
_____ A few times a year
_____ Never before

5. How would you rate your familiarity with the subject you searched today? (Not at UI)

_____ Very familiar
_____ Somewhat familiar
_____ Somewhat unfamiliar
_____ Very unfamiliar

C. Online Searches.

Begin time: __________

End time: __________

1. Search in Online Catalog #1: SOC DOC
Please go ahead and use the online catalog to find what you are looking for. After you finish searching, I am going to ask you to repeat your search for the same topic in a different computer catalog available in this terminal. These 2 computer catalogs have different searching capabilities. As you search this computer catalog, take note of its searching capabilities so that you can compare it with the computer catalog you will later use. We'll talk about the differences and the results of your search after you finish using both catalogs. (Interviewer sits quietly.)

2. Relevance assessment of search #1.

I'd like you to review the items listed on the printout and place a mark to the left of each item listed whether the item was relevant or possibly relevant or not relevant to your search topic; that is, place an "R" (for relevant), a "P" (for possibly relevant), or an "N" (for not relevant) beside listed items on the printout. (Interviewer sits quietly.)

Begin time: __________

End time: __________

3. Search in Online Catalog #2: SOC DOC
Now I'd like you to repeat your online search for the same topic using an online catalog that is very similar to the online catalog you just used except for its searching capabilities. The same bibliographic items are in this online catalog's database. After you finish searching, I am going to ask you some questions about your search. Please go ahead and use this computer catalog and I'll wait until you're finished to ask you the question. (Interviewer sits quietly.)

Appendix I--Continued

4. Relevance Assessment of search #2.

   I'd like you to review the items listed on the printout and place a mark to the left of each item listed whether the item was relevant or not relevant to your search topic; that is, place an "R" (for relevant) and an "N" (for not relevant) beside listed items on the printout. (Interviewer sits quietly.)

D. General Questions. (Note that more space was left in the actual questionnaire under questions D.1-6 so that the interviewer could write down a patron's responses.)

1. Tell me any specific difficulties you had using the FIRST computer catalog. (Probes: information displayed in alphabetical lists, selecting options, knowing what options would do to your search, understanding information - in book item displays - in alphabetical lists - in subject outlines, improvements to this system.)

2. What capability (or function) of the first catalog you used was most helpful for directing you to information relevant to your topic?

3. Tell me any specific difficulties you had using the SECOND computer catalog. (Probes: see D.1.)

4. What capability (or function) of the second catalog you used was most helpful for directing you to information relevant to your topic?

5. What differences between the 2 online catalogs did you notice? (Probes: in the search path you followed, in the retrieved items, in the options provided by the catalogs, in the subject terms listed by the catalogs.)

6. How did these differences help you (or hinder you) to carry out the online search?

7. Comparing the first online catalog you used to the second online catalog, did you find:

   _______ A greater amount of useful information in the first catalog than the second

   _______ About the same amount of information in both catalogs

   _______ A lesser amount of useful information in the first catalog than the second

   _______ No useful information whatsoever in the first catalog in comparison to the second

   _______ No useful information in either catalog

Appendix I--Continued

8. In relation to what you were looking for, would you say your search was more satisfactory using the first or second computer catalog?

______ First (circle: SOC DOC)

______ Second Why?

______ No difference

9. The next time you need to conduct a computer catalog search, will you want to use the first or second computer catalog?

______ First

______ Second Why?

______ No preference

10. Are there any additional comments you care to make concerning your use of the two computer catalogs?

THANK YOU for taking part in our study on computer catalogs. Let me give you a copy of your printout and a reward.

Appendix J. Sample Search Queries Worksheet

Questionnaire #__________

System: SOC DOC

Topic #1. ____

Time Search Begun:______________________ Time Search Ended:____________

List Printed Sources Consulted:

System: SOC DOC

Topic #2. ____

Time Search Begun:______________________ Time Search Ended:____________

List Printed Sources Consulted:

Appendix K. Sample Search Experiment Interviewer Questionnaire

Questionnaire #____________

Library: UI PLCFC NYSL LC First System: SOC DOC

Gender: M F Date:_______ Time:______ Interviewer: KM JT

(Note that more space was left in the actual questionnaire for staff members' answers to open-ended questions to be written down by the interviewer.)

A. Introduction.

Hello. I'm _____________ from the OCLC Online Computer Library Center in Dublin, Ohio, a not-for-profit computer service and research organization for libraries. We are conducting a study to find out how well this online catalog helps library patrons and staff find library material pertinent to their search topics. I am going to ask you to complete a total of 6 online subject searches in this computer catalog. I'll present you with 2 search topics at a time. You will perform online searches for each of these 2 topics in one of the 2 online catalogs accessed by this terminal. These 2 online catalogs have different searching capabilities. As you search, take note of the differences between the two computer catalogs so that we can talk about these differences later. They contain the same bibliographic items. When you finish searches for two topics, I'm going to ask you some questions about the search and ask you to look back at the printed search to determine which retrieved items are relevant to the search topic.

B. Demographic Questions.

1. How many times have you used this online catalog, i.e., the one used for this experiment?

_______ Never before---> Would you like to take about 10 minutes to familiarize yourself with the searching of the catalogs? (Interviewer remains nearby to answer questions and show the user how to change the catalogs from SOC to DOC, or vice versa, DOC to SOC.)

_______ Yes

_______ No

_______ 1 time

_______ 2 times

_______ 3 or more times

Appendix K--Continued

2. Do you use the library's computer catalog:

_______ Daily
_______ Weekly
_______ Monthly
_______ A few times a year
_______ Never before

3. Other than the library's computer catalog, do you use a computer system (including subsystems of the library's automated library system):

_______ Daily
_______ Weekly
_______ Monthly
_______ A few times a year
_______ Never before

4. What category best describes your library work duties:

_______ Administration. Please identify:______________________________
_______ Interlibrary Loan
_______ Reference Services. Please identify:___________________________
_______ Serials Control
_______ Technical Services. Please identify:___________________________
_______ Other. Please identify:_______________________________________

5. How would you rate your familiarity with the subject area(s) of_________ ____________? (Interviewer fills in with subject depending on the library, i.e., economics, trade, management, and commerce at LC; New York State history and geography at NYSL; sports and performing arts at PLCFC; and mathematics at UI.)

_______ Very familiar
_______ Somewhat familiar
_______ Somewhat unfamiliar
_______ Very unfamiliar

C. Search pair 1.

1. On this sheet (handing sheet to librarian) are listed 2 searches for different topics. Please complete an online search for the first online search topic in SOC DOC, change systems, then complete an online search in SOC DOC for the second topic listed. Try to be comprehensive in your search and try more than 1 subject search option. Please do not reverse the order of performing searches for these 2 topics. You can use any printed or online tools you would normally use for a catalog search when performing online searches for both topics. Mark down the time when you begin and end each online search. After you finish searching both topics, I am going to ask you some questions about the searches and search results. So you'll want to print out bibliographic records that you

Appendix K--Continued

retrieve during the search. Please go ahead and use the computer catalog and I'll wait (over there) until you're finished to ask you the questions. (Interviewer sits quietly out of sight.)

2. Tell me any specific difficulties you had using the online catalog to perform the first search listed.

3. Tell me what you would like to help you improve the FIRST online catalog search?

4. What capability (or function) of the first catalog you used was most helpful for directing you to information relevant to the topic?

5. Tell me any specific difficulties you had using the online catalog to perform the SECOND search listed.

6. Tell me what you would like to help you improve the second online catalog search?

7. What capability (or function) of the second catalog you used was most helpful for directing you to information relevant to the topic?

8. What differences between the two online catalogs did you notice? (Probes: in the retrieved items, in the options provided by the catalogs, in the subject terms listed by the catalogs.)

9. How did these differences help you (or hinder you) to carry out the online search?

10. For the 2 searches, which type of catalog was most satisfactory:

_______ SOC Why?

_______ DOC

_______ No difference

11. Please review all the items on this printout and consider each item's relevance to the search topic. Was the item Relevant, Possibly Relevant, or Not Relevant to the search topic? Place an R beside an item you determine Relevant, a P beside an item you determine Possibly Relevant, and an N beside an item you determine Not Relevant. I'll wait (over there) until you are finished to proceed.

D. Search pair 2.

1. On this sheet (handing sheet to librarian) are listed 2 more searches for different topics. Please complete an online search for the first online search topic in SOC DOC, change systems, then complete an online search in

Appendix K--Continued

SOC DOC for the second topic listed. Please do not reverse the order of performing searches. Try to be comprehensive in your search and try more than 1 subject search option. You can use any printed or online tools that you would normally use for a catalog search. Mark down the time when you begin and end each online search. After you finish searching both topics, I am going to ask you some questions about the searches and search results. So you'll want to print out bibliographic records that you retrieve during the search. Please go ahead and use the computer catalog and I'll wait (over there) until you're finished to ask you the questions. (Interviewer sits quietly out of sight.)

2. Tell me any specific difficulties you had using the online catalog to perform the FIRST search listed.

3. Tell me what you would like to help you improve the first online catalog search?

4. What capability (or function) of the first catalog you used was most helpful for directing you to information relevant to the topic?

5. Tell me any specific difficulties you had using the online catalog to perform the SECOND search listed.

6. Tell me what you would like to help you improve the second online catalog search?

7. What capability (or function) of the second catalog you used was most helpful for directing you to information relevant to the topic?

8. What differences between the two online catalogs did you notice? (Probes: in the retrieved items, in the options provided by the catalogs, in the subject terms listed by the catalogs.)

9. How did these differences help you (or hinder you) to carry out the online search?

10. For the 2 searches, which type of catalog was most satisfactory:

_______ SOC Why?

_______ DOC

_______ No difference

11. Please review all the items listed on this printout and consider each item's relevance to the search topic. Was the item Relevant, Possibly Relevant, or Not Relevant to the search topic? Place an R beside an item you determine Relevant, a P beside an item you determine Possibly Relevant, and an N beside an item you determine Not Relevant. I'll wait (over there) until you're finished to proceed. (Interviewer sits quietly out of sight.)

Appendix K--Continued

E. Search Pair 3.

1. On this sheet (handing sheet to librarian) are listed 2 more searches for different topics. Please complete an online search for the first online search topic in SOC DOC, change systems, then complete an online search in SOC DOC for the second topic listed. Try to be comprehensive in your search and try more than 1 subject search option. Please do not reverse the order of performing searches. You can use any printed or online tools that you would normally use for a catalog search. Mark down the time when you begin and end each online search. After you finish searching both topics, I am going to ask you some questions about the searches and search results. So you'll want to print bibliographic records that you retrieve during the search. Please go ahead and use the online catalog and I'll wait (over there) until you're finished to ask you the questions. (Interviewer sits quietly out of sight.)
2. Tell me any specific difficulties you had using the online catalog to perform the FIRST search listed.
3. Tell me what you would like to help you improve the first online catalog search?
4. What capability (or function) of the first catalog you used was most helpful for directing you to information relevant to the topic?
5. Tell me any specific difficulties you had using the online catalog to perform the SECOND search listed.
6. Tell me what you would like to help you improve the second online catalog search?
7. What capability (or function) of the second catalog you used was most helpful for directing you to information relevant to the topic?
8. What differences between the two online catalogs did you notice? (Probes: in the retrieved items, in the options provided by the catalogs, in the subject terms listed by the catalogs.)
9. How did these differences help you (or hinder you) to carry out the online search?
10. For the 2 searches, which type of catalog was most satisfactory:

_______ SOC Why?

_______ DOC

_______ No difference

Appendix K--Continued

11. Please review all the items on this printout and consider each item's relevance to the search topic. Was the item Relevant, Possibly Relevant, or Not Relevant to the search topic? Place an R beside an item you can determine Relevant, a P beside an item you determine Possibly Relevant, and an N beside an item you determine Not Relevant. I'll wait (over there) until you're finished to proceed. (Interviewer sits quietly out of sight.)

F. General Questions.

1. Think about the searches that you performed in SOC. What features, capabilities, and aspects of SOC were particularly desirable? Undesirable? Suggestions to improve the system?

2. Think about the searches that you performed in DOC. What features, capabilities, and aspects of DOC were particularly desirable? Undesirable? Suggestions to improve the system?

3. Overall, do you have a preference for:

_______ SOC Why?

_______ DOC

_______ No preference

4. Are there any additional comments you care to make concerning your use of SOC and DOC?

THANK YOU for participating in our study of computer catalogs.

Appendix L. Expressed Topics Searched by Patrons and Assigned Topics Searched by Staff in Online Retrieval Experiments

A. Forty Search Topics Entered by 40 Library Patrons at The Library of Congress

1. Management of artists in music or theatre
2. French government: national trade and monetary policy
3. Leadership
4. Third world economics
5. Ghana's economics, employment, and industry
6. Finance or debt crisis
7. International capital flows
8. Summer employment for students
9. Fee-based information services
10. Advanced conditioning
11. Telemarketing industry
12. Exports of armaments (France, Switzerland, Canada, Belgium)
13. Investment
14. Measurement of capital stock in Philippine economics
15. Countertrade
16. How to conduct interviews
17. Industry surveys
18. Sub or special languages
19. Health, Medicine, Technology, Electric, Computers
20. International relations
21. Employee relations
22. Employment for accounting
23. Production management
24. (New) manipulative management technique
25. Marketing at the turn of the century
26. Chinese economics
27. Business etiquette
28. Employment in Britain
29. Federal joint ventures
30. Aerospace industry
31. Television
32. Steel industry
33. Silver trade
34. Development economics
35. Banking operations
36. Women managers
37. Solar energy industry
38. Macroeconomics
39. Trade with the "new" Vietnam
40. Effect of U.S. borrowing on world capital supply

Appendix L--Continued

B. Forty-five Search Topics Entered by 45 Library Staff at the Library of Congress

1. Youth employment
2. Multinational corporations
3. Mexico's economic problems
4. Uses of microcomputers in business
5. Starting a small business
6. Effective television advertising
7. Investing in real estate
8. Corporate social responsibility
9. Taxation of corporations
10. Working women in the United States
11. Wind as a source of energy
12. Analysis of Keynesian economics
13. Food problems in third world countries, especially in Africa
14. Natural gas deregulation
15. Stock options
16. Financial planning for retirement
17. Leadership
18. Japanese style of management
19. Women executives
20. Industrial robots
21. How to invest in the stock market
22. Cost of living adjustments on salaries or wages
23. Quality of worklife
24. Cost of medical care in the United States
25. American corporations in South Africa
26. Employees' representation in management
27. Employment of older workers
28. Dictionaries of economics
29. Gold standard
30. Job hunting
31. Corporate mergers
32. Motivating employees
33. Job sharing
34. Home finance
35. Venture capital
36. Pension reform in the United States
37. Conducting successful business meetings
38. Soviet aid to India
39. Terrorism
40. Affirmative Action
41. Economic development in the Soviet Union
42. How to be successful in the mail-order business
43. California wine industry
44. Technology transfer to developing countries
45. Equal pay for equal work

Appendix L--Continued

C. Forty Search Topics Entered by 40 Library Patrons at the New York State Library

1. Poughkeepsie
2. Jamestown
3. Erie Canal
4. Black History of Albany, N.Y.
5. French and Indian War
6. Loyalists and tories
7. Revolutionary War in N.Y.S.
8. General history of Schenectady, N.Y.
9. History of printing in Schenectady, N.Y.
10. N.Y.S. turnpike routes in the 18th and 19th centuries
11. Livingston County
12. Significant women in U.S. colonial history
13. New Lebanon, N.Y.
14. New York genealogy
15. Scottish involvement in the American Revolution
16. Vital records of the Southeastern Counties of N.Y.S.
17. Genealogy of Cohoes and Troy, N.Y.
18. Migration patterns from 1780 to 1850 in N.Y.S.
19. Ramsbottom, and Madison County, N.Y.
20. Adamsville
21. (N.Y.S.) capitol
22. Industrial history in the (N.Y.S.) Capitol District
23. Jewish immigration to the U.S.
24. History of Rochester, N.Y.
25. Cayuga Village
26. Public employees unions
27. Burke in Cortland County, N.Y.
28. Geography of Columbia County, N.Y.
29. Was the oblong a part of Dutchess County, N.Y., or Connecticut, and Amenia in Dutchess County?
30. Athens, N.Y.
31. Indians
32. Glens Falls, N.Y.
33. Civil War
34. Geography of Cayuga County, N.Y.
35. Glens Falls, N.Y.
36. Jemima Wilkinson
37. Steuben County, N.Y.
38. Thomas Jefferson
39. History of Columbia County, N.Y.
40. New Netherlands

Appendix L--Continued

D. Forty-five Search Topics Entered by 15 Library Staff at the New York State Library

1. Fort Niagara
2. 19th century guide-books for touring Niagara Falls
3. Six Nations (Indian confederacy)
4. General Montcalm (of New France)
5. Lake Champlain's role in the American Revolution
6. Vacation ideas in the Catskill Mountains
7. Discovery of America before Christopher Columbus
8. 19th century families living in Niagara County or Niagara Falls (city)
9. Pontiac (Indian war chief)
10. Spanish colonies and settlement in North America
11. Dutch settlement in the city of Albany, N.Y.
12. A history of West Point (United States Military Academy)
13. French discovery and settlement in North America
14. History of the New York State capitol building
15. King Philip's War
16. Governor DeWitt Clinton
17. Turn of the century (around 1900) views of Saratoga Springs
18. Battle of Bushy Run
19. 19th century descriptions of the Thousand Islands
20. Photographs or sketches of the Hudson River (from 1850 to 1910)
21. Discovery of North America by English explorers
22. French and Indian War (from 1755 to 1763)
23. 19th century railroad tours of New York State
24. Colonial history of Long Island (i.e., before the American Revolution)
25. Captain John Smith and his wife, Pocahontas
26. Hiking in the Adirondack Mountains
27. 19th century experiences traveling on New York State's canals
28. Holland purchase by the Holland Land Company
29. Harlem neighborhoods in New York City since 1900
30. Erie Canal
31. Pequot War
32. Founding and early history of the city of Buffalo, N.Y.
33. 19th century families living in Steuben County
34. Role of New York (State) in the American Revolution
35. Dutch discovery and settlement in New York (State)
36. Traveling on the St. Lawrence River
37. Pioneer life on the Western or Niagara Frontier of New York State
38. Bohemian life in Greenwich Village
39. Guide to historical markers in New York State
40. New York State's role in the Civil War
41. Current guide-books on what to do and see in New York (City)
42. 19th century summer resorts in New York State
43. What battles were fought at forts in Oswego, N.Y.?
44. Historical information about Clarksville in Allegany County
45. Life of Jewish immigrants in New York (City)

Appendix L--Continued

E. Forty Search Topics Entered by 40 Library Patrons at the Public Library of Columbus and Franklin County

1. Touch football
2. Boys gymnastics
3. Aerobics
4. NBA basketball and Women's coaching basketball
5. Detective movies
6. Aviation
7. Basketball
8. Karate
9. Equine sports
10. Musical theatre
11. Drama
12. Rules and regulations for playground sports like soccer and football
13. Actors, actresses, atheletes, and musicians of interest
14. Chess
15. Stage movements
16. Broadway theatre
17. Television commercials
18. Mime
19. Bridge
20. Camping
21. Photography
22. Philosophy
23. Bowling
24. Great baseball players
25. Football, Hockey, Racquetball and Ron Reagan
26. Basketball
27. Football
28. Camping vehicles and Carbines
29. Fishing rod building
30. Soccer
31. Cross country skiing
32. Television commercials
33. Ballet
34. Karate
35. Football
36. Tennis
37. Globe theatre
38. Skiing and skin diving
39. Racquetball
40. Ballet

Appendix L--Continued

F. Forty-five Search Topics Entered by 15 Library Staff at the Public Library of Columbus and Franklin County

1. Academy awards
2. Animated cartoons
3. Betting on the horses
4. Blacks in motion pictures
5. Bodybuilding for women
6. Bullfighting
7. Burlesque
8. Camping in cold weather
9. Casino gambling
10. Cave exploring
11. Computer games
12. Cross country skiing
13. Deer hunting
14. Dictionaries for completing crossword puzzles
15. Dirt bikes
16. Fairy chess
17. Falconry
18. Fishing in the Great Lakes or New York State
19. Football defenses
20. Freshwater fishing
21. Game hunting without guns, i.e., with bow and arrow, or crossbow
22. Games using dice
23. Hang gliding
24. History of Vaudeville
25. How to make and fly kites
26. How to put on a bridal shower
27. Ice skating
28. Improving your golf swing
29. Magic tricks
30. Minstrel shows
31. Ohio State football
32. Planning children's parties
33. Putting on puppet plays, especially production of plays
34. Recreational activities for the aged
35. Running the marathon
36. Self defense for women
37. Silent films
38. Skeet shooting
39. Soap operas
40. Soccer strategy
41. Stage make-up
42. Star Trek
43. Teaching infants to swim
44. White water rafting
45. Winter Olympics

Appendix L--Continued

G. Forty Search Topics Entered by Library Patrons at the University of Illinois

1. Combinatorial analysis
2. Mathematician
3. Vortex dynamics
4. Textbooks in calculus
5. Polar coordinates
6. Group theory
7. Statistics
8. Graph theory, specifically Hamiltonian circuits
9. Mathematical physics
10. Statistics
11. Mathematical logic: incompleteness theorem
12. Algebra
13. Rings
14. Vector analysis
15. Mathematicians
16. Numerical methods
17. Integration by substitution of parts
18. Series
19. Natural growth and decay
20. Game theory
21. Theoretical mathematics
22. Natural logarithms
23. Combinatorics
24. Differential equations
25. Double integrals
26. Writing computer programs to graph functions
27. Implicit differentiation
28. Group theory
29. Statistics
30. Time series analysis
31. Laplace transforms
32. Analytical geometry
33. Derivatives
34. Matrix
35. Differentiating trigonometric functions
36. Vector algebra
37. Analytic number theory
38. Trigonometric functions
39. Linear algebra
40. Fourier series

Appendix L--Continued

H. Forty-five Search Topics Entered by 15 Library Staff at the University of Illinois

1. Tensor calculus
2. Computers as an aid to mathematical statistics
3. Cauchy's problem
4. Multivariate analysis
5. Sets and set theory
6. Galois theory
7. Combinatorial topology
8. Hilbert spaces
9. Bessel functions
10. Descriptive statistics
11. Queuing theory
12. Lebesque integral
13. Beginning texts on linear algebra
14. Proof theory
15. Functional analysis
16. Statistical tables
17. Quality control
18. Gamma function tables
19. Martingales
20. Control theory
21. Theory of groups
22. Integral geometry
23. Riemannian geometry
24. Hyperbolic equations
25. Conformal mapping
26. Vector analysis
27. Model theory
28. Constructive mathematics
29. Knot theory
30. Intuitionistic logic or intuitionism
31. Eigenvalues (in Matrix algebra)
32. Interpolation method
33. Determining sample size
34. Meromorphic functions
35. Linear programming
36. Finsler geometry
37. Probabilistic processes
38. How to construct graphs
39. Elementary number theory
40. Affine geometry
41. Decision theory
42. Combinatorial analysis
43. Rings
44. Time series analysis
45. Analytic number theory

Appendix M. SOC Search

```
               LIBRARY OF CONGRESS - SOCIAL SCIENCE READING ROOM
               ---------------------------------------------------

You are searching a bibliography of 11,865 items in the Library of Congress
on Economics, Trade, Commerce, and Management by using either the Subject
Online Catalog or Dewey Online Catalog.

Do you want to use Catalog a or z? (Enter a or z) > a
```

Start of a SOC search session

```
          ___________________________________________________________
          |                                                         |
          |                SUBJECT ONLINE CATALOG A                 |
          |                                                         |
          |  * Search for subject and browse an alphabetical        |
          |    list of subjects near your subject (SA).             |
          |  * Search directly for subject and retrieve number      |
          |    of items on your subject (SD).                       |
          |  * Search directly for call number and retrieve         |
          |    number of items with your call number (SC).          |
          |                                                         |
          |  Remember to end your typing with the "RETURN" key,     |
          |  and erase with the "DELETE" key.                       |
          |                                                         |
          -----------------------------------------------------------

OPTION DESCRIPTION
    SA Search alphabetically for subject
    SD Search directly for subject
    SC Search for call number
    ES End search

What would you like to do? > sa personal loans
```

Alphabetical Search

```
>>>>> YOUR REQUEST...sa:personal loans

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
  IF YOUR SUBJECT IS NOT LISTED, TRY ANOTHER SEARCH OPTION.
LINE ITEMS TOPICS--ASPECTS
   A      1 Perpetuities--New Zealand
   B      1 Persian Gulf region--Foreign economic relations--Japan
   C      2 Personality
   D      1 Personality and occupation
   E      1 Personnel departments
   F      1 Personnel departments--United States--Statistics
   G     44 Personnel management
   H      5 Personnel management--Addresses, essays, lectures
   I      2 Personnel management--Case studies
   J      1 Personnel management--Communist countries
```

Appendix M--Continued

```
OPTION  DESCRIPTION
    BF  Browse forward in this alphabetical list
    BB  Browse backward in this alphabetical list
    SD  Search directly for "personal loans"
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > so

>>>>> YOUR REQUEST...so

OPTION  DESCRIPTION
    SA  Search alphabetically for subject
    SD  Search directly for subject
    SC  Search for call number
    ES  End search

What would you like to do? > sa loans, personal

>>>>> YOUR REQUEST...sa:loans, personal

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
  IF YOUR SUBJECT IS NOT LISTED, TRY ANOTHER SEARCH OPTION.
LINE ITEMS TOPICS--ASPECTS
   A      2 Loans, Foreign--South Africa
   B      1 Loans, Foreign--Statistics
   C      1 Loans, Personal--Great Britain--History
   D      2 Loans, Personal--Handbooks, manuals, etc.
   E      1 Loans--Government guaranty--Law and legislation--United Stat
   F      2 Loans--Handbooks, manuals, etc.
   G      3 Loans--United States--Government guaranty
   H      1 Lobbying--United States
   I      1 Lobster fisheries--Florida--Florida Keys
   J      1 Lobster fisheries--New Zealand--Statistics

OPTION  DESCRIPTION
    BF  Browse forward in this alphabetical list
    BB  Browse backward in this alphabetical list
    SD  Search directly for "loans, personal"
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > sl c,d

>>>>> YOUR REQUEST...sl c,d
        3 ITEMS IN SET 1  (Loans, Personal--Great Britain--History ...)
```

Item Selection

Appendix M--Continued

```
ITEM 1 OF 3
DEWEY NUMBER     332.34
LC CALL NUMBER   HG2106.G6 T4 1983
TITLE            Making ends meet : pawnbroking and working-class credit
LC SUBJECT       Pawnbroking--Great Britain--History
                 Loans, Personal--Great Britain--History
                 Cost and standard of living--Great Britain--History
                 Women--Great Britain--Economic conditions--History
AUTHOR           Tebbutt, Melanie.
PUBLISHER        Leicester [Leicestershire] : Leicester University Press ; New
                 York : St. Martin's Press, 1983.

Would you like to see the next item? ("RETURN"=yes, N=no) >↲


ITEM 2 OF 3
DEWEY NUMBER     332.743
LC CALL NUMBER   HG3755 .G48 1982
TITLE            The complete guide to credit and loans
LC SUBJECT       Consumer credit--Handbooks, manuals, etc.
                 Loans, Personal--Handbooks, manuals, etc.
AUTHOR           Gibbs, Gerald W.
PUBLISHER        New York, N.Y. : Playboy Paperbacks, c1982.

Would you like to see the next item? ("RETURN"=yes, N=no) >↲


ITEM 3 OF 3
DEWEY NUMBER     332.7430202
LC CALL NUMBER   HG3755 .N365 1982
TITLE            Where to get money for everything : a strategic guide to
                 today's money sources
LC SUBJECT       Loans, Personal--Handbooks, manuals, etc.
                 Credit--Handbooks, manuals, etc.
AUTHOR           Nelson, Paula, 1945-
EDITION          1st ed.
PUBLISHER        New York : Morrow, 1982.
---------------- END OF DISPLAY ----------------
Press "RETURN" to resume search >↲


* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER FOR YOUR SUBJECT.

LINE ITEMS TOPICS--ASPECTS
   A     2 Loans, Foreign--South Africa
   B     1 Loans, Foreign--Statistics
   C     1 Loans, Personal--Great Britain--History
   D     2 Loans, Personal--Handbooks, manuals, etc.
   E     1 Loans--Government guaranty--Law and legislation--United Stat
   F     2 Loans--Handbooks, manuals, etc.
   G     3 Loans--United States--Government guaranty
   H     1 Lobbying--United States
   I     1 Lobster fisheries--Florida--Florida Keys
   J     1 Lobster fisheries--New Zealand--Statistics
```

Appendix M--Continued

```
OPTION  DESCRIPTION
    BF  Browse forward in this alphabetical list
    BB  Browse backward in this alphabetical list
    SD  Search directly for "loans, personal"
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > bf
```

Browsing of List of Aspects

```
>>>>> YOUR REQUEST...bf

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER FOR YOUR SUBJECT.

LINE ITEMS TOPICS--ASPECTS
   A     1 Lobster fisheries--New Zealand--Statistics
   B     1 Lobster fisheries--Thailand
   C     1 Local finance--Appalachian Mountains Region
   D     2 Local finance--California
   E     1 Local finance--Great Britain
   F     1 Local finance--Handbooks, manuals, etc.
   G     1 Local finance--India
   H     1 Local finance--Iowa
   I     1 Local finance--Minnesota
   J     1 Local finance--New Mexico--Sandoval County

OPTION  DESCRIPTION
    BF  Browse forward in this alphabetical list
    BB  Browse backward in this alphabetical list
    SD  Search directly for "loans, personal"
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > bf

>>>>> YOUR REQUEST...bf

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER FOR YOUR SUBJECT.

LINE ITEMS TOPICS--ASPECTS
   A     1 Local finance--New Mexico--Sandoval County
   B     1 Local finance--Oregon--History
   C     1 Local finance--Philippines--Addresses, essays, lectures
   D     1 Local finance--Quebec (Province)
   E     2 Local finance--United States
   F     1 Local finance--United States--Bibliography
   G     1 Local government
   H     1 Local government--California
   I     1 Local government--Scotland
   J     2 Local government--United States
```

Appendix M--Continued

```
OPTION  DESCRIPTION
    BF  Browse forward in this alphabetical list
    BB  Browse backward in this alphabetical list
    SD  Search directly for "loans, personal"
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > sd
```

Direct Search

```
>>>>> YOUR REQUEST...sd:loans  personal
       111 ITEMS FOR "loans"
       139 ITEMS FOR "personal"
         3 ITEMS IN SET 2  (loans  personal)

   THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
   SET  ITEMS    REQUEST
     1      3    sa:Loans, Personal--Great Britain--History ...
     2      3    sd:loans  personal

OPTION  DESCRIPTION
    DI  Display items
    SO  Start over

What would you like to do? > di 2
di 2
```

Display of items

```
>>>>> YOUR REQUEST...di 2


ITEM 1 OF 3
DEWEY NUMBER     332.34
LC CALL NUMBER   HG2106.G6 T4 1983
TITLE            Making ends meet : pawnbroking and working-class credit
LC SUBJECT       Pawnbroking--Great Britain--History
                 Loans, Personal--Great Britain--History
                 Cost and standard of living--Great Britain--History
                 Women--Great Britain--Economic conditions--History
AUTHOR           Tebbutt, Melanie.
PUBLISHER        Leicester [Leicestershire] : Leicester University Press ; New
                 York : St. Martin's Press, 1983.

Would you like to see the next item? ("RETURN"=yes, N=no) >n


   THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
   SET  ITEMS    REQUEST
     1      3    sa:Loans, Personal--Great Britain--History ...
     2      3    sd:loans  personal

OPTION  DESCRIPTION
    DI  Display items
    SO  Start over

What would you like to do? > so
```

Appendix M--Continued

```
>>>>> YOUR REQUEST...so

OPTION  DESCRIPTION
    SA  Search alphabetically for subject
    SD  Search directly for subject
    SC  Search for call number
    RS  Review your searches
    ES  End search

What would you like to do? > sc  332.743
```

Call Number Search

```
>>>>> YOUR REQUEST...sc: 332.743
       10 ITEMS IN SET 3  ( 332.743)

   THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
   SET  ITEMS    REQUEST
     1      3    sa:Loans, Personal--Great Britain--History ...
     2      3    sd:loans  personal
     3     10    sc: 332.743

OPTION  DESCRIPTION
    DI  Display items
    SO  Start over

What would you like to do? > di 3
```

Display of Items

```
>>>>> YOUR REQUEST...di 3


ITEM 1 OF 10
DEWEY NUMBER      332.743
LC CALL NUMBER    HG3756.C3 F7 1981
TITLE             Credit, a mortgage for life : a review of consumer debt and
                  credit in Canada and the impact of increasing shelter costs on
                  the nature of debt
LC SUBJECT        Consumer credit--Canada
                  Debt--Canada
                  Mortgage loans--Canada
                  Housing--Canada--Finance
AUTHOR            Frazer, Debra.
                  McClain, Janet.
PUBLISHER         Ottawa, Ont. : Canadian Council on Social Development, 1981.

Would you like to see the next item? ("RETURN"=yes, N=no) >↲


ITEM 2 OF 10
DEWEY NUMBER      332.743
LC CALL NUMBER    HG3755 .G48 1982
TITLE             The complete guide to credit and loans
LC SUBJECT        Consumer credit--Handbooks, manuals, etc.
                  Loans, Personal--Handbooks, manuals, etc.
AUTHOR            Gibbs, Gerald W.
PUBLISHER         New York, N.Y. : Playboy Paperbacks, c1982.

Would you like to see the next item? ("RETURN"=yes, N=no) >↲
```

Appendix M--Continued

```
ITEM 3 OF 10
DEWEY NUMBER     332.743
LC CALL NUMBER   HG3755 .J58 1981
TITLE            Credit, get it, use it, stretch it, save it
LC SUBJECT       Consumer credit--Handbooks, manuals, etc.
AUTHOR           Johnson, Bert.
PUBLISHER        San Francisco : Harbor Pub. ; [New York] : Distributed by
                 Putnam, c1981.

Would you like to see the next item? ("RETURN"=yes, N=no) >↲


ITEM 4 OF 10
DEWEY NUMBER     332.743
LC CALL NUMBER   HG2040.4 .K57 1982
TITLE            How to make energy conservation pay for itself : creative
                 financing for energy efficiency improvements
LC SUBJECT       Home improvement loans--United States
                 Dwellings--United States--Remodeling--Finance
                 Dwellings--Energy conservation
                 Dwellings--Insulation
                 Energy tax credits--United States
AUTHOR           Klepper, Martin.
                 National Community Energy Management Center (U.S.)
PUBLISHER        Washington, D.C. (400 N. Capitol St., N.W., Washington 20001) :
                 National Community Energy
Management Center, c1982.

Would you like to see the next item? ("RETURN"=yes, N=no) >↲

ITEM 5 OF 10
DEWEY NUMBER     332.743
LC CALL NUMBER   HG2040.4 .K573 1982
TITLE            Innovative financing for energy efficiency improvements : phase
                 I report
LC SUBJECT       Home improvement loans--United States
                 Dwellings--United States--Remodeling--Finance
                 Dwellings--Energy conservation
                 Dwellings--Insulation
                 Energy tax credits--United States
AUTHOR           Klepper, Martin.
                 Sherman, Joseph (Joseph L.)
                 Carroll, Megan.
PUBLISHER        Washington, DC (1800 M St., NW, Washington) : Lane and Edson,
                 [1982]

Would you like to see the next item? ("RETURN"=yes, N=no) >↲
```

Appendix M--Continued

```
ITEM 6 OF 10
DEWEY NUMBER      332.743
LC CALL NUMBER    HG3755 .P63 1983
TITLE             How to borrow money
LC SUBJECT        Consumer credit--Handbooks, manuals, etc.
                  Credit--Handbooks, manuals, etc.
                  Credit bureaus--Handbooks, manuals, etc.
AUTHOR            Pollan, Stephen M.
                  Roel, Raymond A.
                  Roel, Ronald E.
PUBLISHER         New York : Simon & Schuster, c1983.

Would you like to see the next item? ("RETURN"=yes, N=no) >↲


ITEM 7 OF 10
DEWEY NUMBER      332.743
LC CALL NUMBER    HG3756.U54 P76 1979
TITLE             Problems of consumer credit : proceedings of a conference held
                  at Middle Tennessee State University, January 1979
LC SUBJECT        Consumer credit--United States--Congresses
                  Consumer credit--Tennessee--Congresses
AUTHOR            Hendershot, Paul T., 1916-
                  Douthit, James C.
                  Middle Tennessee State University. School of Business. Dept. of
                  Management and Marketing.
                  Middle Tennessee State University. Office of Continuing
                  Education.
SPONSOR           Consumer Credit Seminar (1979 : Middle Tennessee State
                  University)
PUBLISHER         Murfreesboro, Tenn. : Business and Economic Research Center,
                  Middle Tennessee State University, [1979]
SERIES            Monograph series / Business and Economic Research Center,
                  Middle Tennessee State University ;

Would you like to see the next item? ("RETURN"=yes, N=no) >↲


ITEM 8 OF 10
DEWEY NUMBER      332.743
LC CALL NUMBER    HG3755 .T37 1983
TITLE             Consumer lending
LC SUBJECT        Consumer credit
AUTHOR            Taylor, John Renford.
                  American Bankers Association.
PUBLISHER         Reston, Va. : Reston Pub. Co. ; Washington, D.C. : American
                  Bankers Association, c1983.

Would you like to see the next item? ("RETURN"=yes, N=no) >↲
```

Appendix M--Continued

```
ITEM 9 OF 10
DEWEY NUMBER     332.743
LC CALL NUMBER   HG3755 .W53 1982
TITLE            The consumer credit decision : a practical approach
LC SUBJECT       Consumer credit--Study and teaching--Handbooks, manuals, etc.
                 Bank loans--Study and teaching--Handbooks, manuals, etc.
AUTHOR           Wills, Ronald Kent.
                 American Bankers Association.
PUBLISHER        Washington, D.C. : American Bankers Association, c1982.
SERIES           Leader's guide / American Bankers Association

Would you like to see the next item? ("RETURN"=yes, N=no) >↲


ITEM 10 OF 10
DEWEY NUMBER     332.7430202
LC CALL NUMBER   HG3755 .N365 1982
TITLE            Where to get money for everything : a strategic guide to
                 today's money sources
LC SUBJECT       Loans, Personal--Handbooks, manuals, etc.
                 Credit--Handbooks, manuals, etc.
AUTHOR           Nelson, Paula, 1945-
EDITION          1st ed.
PUBLISHER        New York : Morrow, 1982.
---------------- END OF DISPLAY ----------------
Press "RETURN" to resume search >↲


   THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
   SET  ITEMS    REQUEST
     1      3    sa:Loans, Personal--Great Britain--History ...
     2      3    sd:loans  personal
     3     10    sc: 332.743

OPTION  DESCRIPTION
    DI  Display items
    SO  Start over

What would you like to do? >
```

Appendix N. DOC Search

```
             LIBRARY OF CONGRESS - SOCIAL SCIENCE READING ROOM
             ------------------------------------------------

You are searching a bibliography of 11,865 items in the Library of Congress
on Economics, Trade, Commerce, and Management by using either the Subject
Online Catalog or Dewey Online Catalog.

Do you want to use Catalog a or z? (Enter a or z) > z
```

Start of a DOC search session

```
        ------------------------------------------------------
        |            SUBJECT ONLINE CATALOG Z                 |
        |  * Search for subject and browse an alphabetical    |
        |    list of subjects near your subject (SA).         |
        |  * Search for subject and browse an outline of      |
        |    subjects related to your subject (SS).           |
        |  * Search directly for subject and retrieve number  |
        |    of items on your subject (SD).                   |
        |  * Search for call number and browse an outline of  |
        |    meanings of call numbers (SC).                   |
        |                                                     |
        | Remember to end your typing with the "RETURN" key,  |
        | and erase with the "DELETE" key.                    |
        -------------------------------------------------------

OPTION  DESCRIPTION
    SA  Search alphabetically for subject
    SS  Search subject outline for subject
    SD  Search directly for subject
    SC  Search for call number
    ES  End search

What would you like to do? > sa personal loans
```

Alphabetical Search

```
>>>>> YOUR REQUEST...sa:personal loans

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
  IF YOUR SUBJECT IS NOT LISTED, TRY ANOTHER SEARCH OPTION.
LINE ITEMS TOPICS--ASPECTS
   A      2 Performance--evaluation--executive management
   B     32 Performance--surveys--personnel administration--general mana
   C     21 Personal--distribution--national income
   D     59 Personal--finance--economics
   E      7 Personal--income taxes--public finance
   F      1 Personal--income--macroeconomics
   G      1 Personal--income--tax reductions--public finance
   H     10 Personal--loans--economics
   I      5 Personal--qualifications--employees--selection--general mana
   J     33 Personal--selling--marketing management
```

Appendix N--Continued

```
OPTION  DESCRIPTION
    BF  Browse forward in this alphabetical list
    BB  Browse backward in this alphabetical list
    ST  Search subject outline for a topic from the list
    SS  Search subject outline for "personal loans"
    SD  Search directly for "personal loans"
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > sl h
```

Item Selection

```
>>>>> YOUR REQUEST...sl h
       10 ITEMS IN SET 1  (Personal--loans--economics)


ITEM 1 OF 10
DEWEY NUMBER      332.743
LC CALL NUMBER    HG3756.C3 F7 1981
TITLE             Credit, a mortgage for life : a review of consumer debt and
                  credit in Canada and the impact of increasing shelter costs on
                  the nature of debt
LC SUBJECT        Consumer credit--Canada
                  Debt--Canada
                  Mortgage loans--Canada
                  Housing--Canada--Finance
DEWEY SUBJECT     Other forms of credit. Personal loans.
AUTHOR            Frazer, Debra.
                  McClain, Janet.
PUBLISHER         Ottawa, Ont. : Canadian Council on Social Development, 1981.

Would you like to see the next item? ("RETURN"=yes, N=no) >↲


ITEM 2 OF 10
DEWEY NUMBER      332.743
LC CALL NUMBER    HG3755 .G48 1982
TITLE             The complete guide to credit and loans
LC SUBJECT        Consumer credit--Handbooks, manuals, etc.
                  Loans, Personal--Handbooks, manuals, etc.
DEWEY SUBJECT     Other forms of credit. Personal loans.
AUTHOR            Gibbs, Gerald W.
PUBLISHER         New York, N.Y. : Playboy Paperbacks, c1982.

Would you like to see the next item? ("RETURN"=yes, N=no) >↲


ITEM 3 OF 10
DEWEY NUMBER      332.743
LC CALL NUMBER    HG3755 .J58 1981
TITLE             Credit, get it, use it, stretch it, save it
LC SUBJECT        Consumer credit--Handbooks, manuals, etc.
DEWEY SUBJECT     Other forms of credit. Personal loans.
AUTHOR            Johnson, Bert.
PUBLISHER         San Francisco : Harbor Pub. ; [New York] : Distributed by
                  Putnam, c1981.

Would you like to see the next item? ("RETURN"=yes, N=no) >↲
```

Appendix N--Continued

```
ITEM 4 OF 10
DEWEY NUMBER     332.743
LC CALL NUMBER   HG2040.4 .K57 1982
TITLE            How to make energy conservation pay for itself : creative
                 financing for energy efficiency improvements
LC SUBJECT       Home improvement loans--United States
                 Dwellings--United States--Remodeling--Finance
                 Dwellings--Energy conservation
                 Dwellings--Insulation
                 Energy tax credits--United States
DEWEY SUBJECT    Other forms of credit. Personal loans.
AUTHOR           Klepper, Martin.
                 National Community Energy Management Center (U.S.)
PUBLISHER        Washington, D.C. (400 N. Capitol St., N.W., Washington 20001) :
                 National Community Energy Management Center, c1982.

Would you like to see the next item? ("RETURN"=yes, N=no) >n

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER FOR YOUR SUBJECT.

LINE ITEMS TOPICS--ASPECTS
   A     2 Performance--evaluation--executive management
   B    32 Performance--surveys--personnel administration--general mana
   C    21 Personal--distribution--national income
   D    59 Personal--finance--economics
   E     7 Personal--income taxes--public finance
   F     1 Personal--income--macroeconomics
   G     1 Personal--income--tax reductions--public finance
   H    10 Personal--loans--economics
   I     5 Personal--qualifications--employees--selection--general mana
   J    33 Personal--selling--marketing management

OPTION  DESCRIPTION
    BF  Browse forward in this alphabetical list
    BB  Browse backward in this alphabetical list
    ST  Search subject outline for a topic from the list
    SS  Search subject outline for "personal loans"
    SD  Search directly for "personal loans"
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > sd

>>>>> YOUR REQUEST...sd:personal loans
      397 ITEMS FOR "personal"
      159 ITEMS FOR "loans"
       12 ITEMS IN SET 2  (personal loans)

   THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
   SET  ITEMS    REQUEST
     1     10    sa:Personal--loans--economics
     2     12    sd:personal loans
```

Direct Search

Appendix N--Continued

```
OPTION  DESCRIPTION
    DI  Display items
    SO  Start over

What would you like to do? > di 2
```

Display of items

```
>>>>> YOUR REQUEST...di 2


ITEM 1 OF 12
DEWEY NUMBER     332.34
LC CALL NUMBER   HG2106.G6 T4 1983
TITLE            Making ends meet : pawnbroking and working-class credit
LC SUBJECT       Pawnbroking--Great Britain--History
                 Loans, Personal--Great Britain--History
                 Cost and standard of living--Great Britain--History
                 Women--Great Britain--Economic conditions--History
DEWEY SUBJECT    Credit and loan institutions. Loan brokers.
AUTHOR           Tebbutt, Melanie.
PUBLISHER        Leicester [Leicestershire] : Leicester University Press ; New
                 York : St. Martin's Press, 1983.

Would you like to see the next item? ("RETURN"=yes, N=no) >↲


ITEM 2 OF 12
DEWEY NUMBER     332.72
LC CALL NUMBER   KF26 .J8376 1983
TITLE            Farm and home foreclosures : hearing before the Subcommittee on
                 Courts of the Committee on the Judiciary, United States Senate,
                 Ninety-eighth Congress, first session, on farm and home
                 foreclosures and related personal bankruptcies, March 14, 1983.
LC SUBJECT       Foreclosure--United States
                 Bankruptcy--United States
                 Family farms--United States
DEWEY SUBJECT    Credit. Real-estate finance and mortgages.
PUBLISHER        Washington : U.S. G.P.O., 1983.

Would you like to see the next item? ("RETURN"=yes, N=no) >n


   THE FOLLOWING IS A SUMMARY OF YOUR SEARCHES:
   SET  ITEMS    REQUEST
     1     10    sa:Personal--loans--economics
     2     12    sd:personal loans

OPTION  DESCRIPTION
    DI  Display items
    SO  Start over

What would you like to do? > so

>>>>> YOUR REQUEST...so
```

Appendix N--Continued

```
OPTION  DESCRIPTION
    SA  Search alphabetically for subject
    SS  Search subject outline for subject
    SD  Search directly for subject
    SC  Search for call number
    RS  Review your searches
    ES  End search

What would you like to do? > sa personal loans
```

Alphabetical Search

```
>>>>> YOUR REQUEST...sa:personal loans

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER.
  IF YOUR SUBJECT IS NOT LISTED, TRY ANOTHER SEARCH OPTION.
LINE ITEMS TOPICS--ASPECTS
   A      2 Performance--evaluation--executive management
   B     32 Performance--surveys--personnel administration--general mana
   C     21 Personal--distribution--national income
   D     59 Personal--finance--economics
   E      7 Personal--income taxes--public finance
   F      1 Personal--income--macroeconomics
   G      1 Personal--income--tax reductions--public finance
   H     10 Personal--loans--economics
   I      5 Personal--qualifications--employees--selection--general mana
   J     33 Personal--selling--marketing management

OPTION  DESCRIPTION
    BF  Browse forward in this alphabetical list
    BB  Browse backward in this alphabetical list
    ST  Search subject outline for a topic from the list
    SS  Search subject outline for "personal loans"
    SD  Search directly for "personal loans"
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > bf
```

Browsing of List of Aspects

```
>>>>> YOUR REQUEST...bf

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER FOR YOUR SUBJECT.

LINE ITEMS TOPICS--ASPECTS
   A     33 Personal--selling--marketing management
   B     67 Personnel--management--general management
   C     28 Personnel--management--general management--executive
   D      5 Personnel--policy and planning--general management
   E      2 Personnel--services--general management
   F      3 Personnel--utilization--general management
   G     31 Petroleum--resources--economics
   H      1 Photography--advertising operations
   I      2 Physical--conditions of work--personnel administration--gene
   J      2 Physical--location of plant--management

OPTION  DESCRIPTION
    BF  Browse forward in this alphabetical list
    BB  Browse backward in this alphabetical list
    ST  Search subject outline for a topic from the list
    SS  Search subject outline for "personal loans"
    SD  Search directly for "personal loans"
    SL  Select line(s) to display items
    SO  Start over
```

Appendix N--Continued

```
What would you like to do? > bb

>>>>> YOUR REQUEST...bb

* CHECK THIS LIST OF SUBJECTS IN ALPHABETICAL ORDER FOR YOUR SUBJECT.

LINE ITEMS TOPICS--ASPECTS
   A     2 Performance--evaluation--executive management
   B    32 Performance--surveys--personnel administration--general mana
   C    21 Personal--distribution--national income
   D    59 Personal--finance--economics
   E     7 Personal--income taxes--public finance
   F     1 Personal--income--macroeconomics
   G     1 Personal--income--tax reductions--public finance
   H    10 Personal--loans--economics
   I     5 Personal--qualifications--employees--selection--general mana
   J    33 Personal--selling--marketing management

OPTION  DESCRIPTION
    BF  Browse forward in this alphabetical list
    BB  Browse backward in this alphabetical list
    ST  Search subject outline for a topic from the list
    SS  Search subject outline for "personal loans"
    SD  Search directly for "personal loans"
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > st h
```

Topic Search

```
>>>>> YOUR REQUEST...st h


ITEMS ON YOUR SUBJECT ARE FOUND UNDER 332.743 IN THIS OUTLINE OF RELATED
SUBJECTS.

GENERAL TOPIC : 332.74 Other forms of credit
    LINE  ITEMS  AREA              TOPIC
       A      3  332.742           Commercial, mercantile, industrial
*      B     10  332.743           Personal loans

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > bg
```

Browsing of List of Topics

```
>>>>> YOUR REQUEST...bg
```

Appendix N--Continued

```
GENERAL TOPIC : 332.7 Credit
    LINE  ITEMS  AREA            TOPIC
      A     23   332.71          Agricultural credit
      B     46   332.72          Real-estate finance and mortgages
      C     13   332.74          Other forms of credit
      D      3   332.75          Credit restrictions and collapse
      E      2   332.76          Credit instruments
      F      2   332.77          Commercial paper
What would you like to do? > bs c

>>>>> YOUR REQUEST...bs c


THERE ARE NO MORE SPECIFIC TOPICS.


GENERAL TOPIC : 332.74 Other forms of credit
    LINE  ITEMS  AREA            TOPIC
      A      3   332.742         Commercial, mercantile, industrial
      B     10   332.743         Personal loans

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > so


OPTION  DESCRIPTION
    SA  Search alphabetically for subject
    SS  Search subject outline for subject
    SD  Search directly for subject
    SC  Search for call number
    RS  Review your searches
    ES  End search

What would you like to do? > ss personal loans
```

Subject Outline Search

```
>>>>> YOUR REQUEST...ss:personal loans

  Please wait .

ITEMS ON YOUR SUBJECT ARE FOUND UNDER 332.743 IN THIS OUTLINE OF RELATED
SUBJECTS.

GENERAL TOPIC : 332.74 Other forms of credit
    LINE  ITEMS  AREA            TOPIC
      A      3   332.742         Commercial, mercantile, industrial
*     B     10   332.743         Personal loans
```

Appendix N--Continued

```
OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > gn b
```

Display of DDC Information

```
>>>>> YOUR REQUEST...gn b

DETAILED NOTES FOR TOPIC : Personal loans

AREA             332.743
TOPIC            Personal loans
INCLUDING        Including chattel mortgages, consumer credit
DEWEY INDEX      Consumer--credit--economics
                 Pawnbroking--economics
                 Personal--loans--economics
                 Secured transactions--credit economics

Press "RETURN" to resume search >↲


GENERAL TOPIC : 332.74 Other forms of credit
    LINE  ITEMS  AREA           TOPIC
       A      3  332.742        Commercial, mercantile, industrial
*      B     10  332.743        Personal loans

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > sl b
```

Item Selection

```
>>>>> YOUR REQUEST...sl b
       10 ITEMS IN SET 3  (332.743 Personal loans)


ITEM 1 OF 10
DEWEY NUMBER     332.743
LC CALL NUMBER   HG3756.C3 F7 1981
TITLE            Credit, a mortgage for life : a review of consumer debt and
                 credit in Canada and the impact of increasing shelter costs on
                 the nature of debt
LC SUBJECT       Consumer credit--Canada
                 Debt--Canada
                 Mortgage loans--Canada
                 Housing--Canada--Finance
DEWEY SUBJECT    Other forms of credit. Personal loans.
AUTHOR           Frazer, Debra.
                 McClain, Janet.
PUBLISHER        Ottawa, Ont. : Canadian Council on Social Development, 1981.

Would you like to see the next item? ("RETURN"=yes, N=no) >n
```

Appendix N--Continued

```
GENERAL TOPIC : 332.74 Other forms of credit
    LINE  ITEMS  AREA            TOPIC
       A      3  332.742         Commercial, mercantile, industrial
*      B     10  332.743         Personal loans

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    SO  Start over
What would you like to do? > so

>>>>> YOUR REQUEST...so

OPTION  DESCRIPTION
    SA  Search alphabetically for subject
    SS  Search subject outline for subject
    SD  Search directly for subject
    SC  Search for call number
    RS  Review your searches
    ES  End search

What would you like to do? > sc 332.743
```

Call Number Search

```
>>>>> YOUR REQUEST...sc:332.743


ITEMS ON YOUR SUBJECT ARE FOUND UNDER 332.743 IN THIS OUTLINE OF RELATED
SUBJECTS.

GENERAL TOPIC : 332.74 Other forms of credit
    LINE  ITEMS  AREA            TOPIC
       A      3  332.742         Commercial, mercantile, industrial
*      B     10  332.743         Personal loans

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    SO  Start over

What would you like to do? > so

>>>>> YOUR REQUEST...so

OPTION  DESCRIPTION
    SA  Search alphabetically for subject
    SS  Search subject outline for subject
    SD  Search directly for subject
    SC  Search for call number
    RS  Review your searches
    ES  End search
```

Appendix N--Continued

Subject Outline Search

```
What would you like to do? > ss loans

>>>>> YOUR REQUEST...ss:loans

  Please wait .....................
YOUR SUBJECT IS TREATED FROM 5  PERSPECTIVES:

LINE  PERSPECTIVES
   A  Financial economics
   B  Public finance
   C  Production
   D  International commerce (Foreign trade)
   E  General management

OPTION  DESCRIPTION
    BP  Browse a perspective
    SO  Start over
```

Browsing of a Perspective

```
What would you like to do? > bp d

>>>>> YOUR REQUEST...bp d


ITEMS ON YOUR SUBJECT ARE FOUND UNDER 382.173 IN THIS OUTLINE OF RELATED
SUBJECTS.

GENERAL TOPIC : 382.17 Balance of payments
    LINE  ITEMS  AREA            TOPIC
       A      0  382.172         Current transactions
*      B      2  382.173         Capital transactions
       C      0  382.174         Currency movements

OPTION  DESCRIPTION
    BG  Browse more general topics
    BS  Browse more specific topics
    GN  Get detailed notes for a topic
    SL  Select line(s) to display items
    RP  Return to perspectives list
    SO  Start over
```

Display of List of Perspectives

```
>>>>> YOUR REQUEST...rp

LINE  PERSPECTIVES
   A  Financial economics
   B  Public finance
   C  Production
   D  International commerce (Foreign trade)
   E  General management

OPTION  DESCRIPTION
    BP  Browse a perspective
    SO  Start over

What would you like to do? >
```

Appendix O. Number of Words and Unique Words per Subject-rich Field in Bibliographic Records

	Subject Headings	Title	(Bibliographic Record) Notes	Series	Sponsor	Relative Index Entries	Schedule Captions and Notes	Total
LC								
Total words	107,000	89,731	11,465	25,720	3,251	99,996	197,919	535,082
Average	9.02	7.56	0.97	2.17	0.27	8.43	16.68	45.10
Total unique words	73,920	80,792	9,289	19,145	3,189	60,928	161,035	408,298
Average	6.23	6.81	0.78	1.61	0.27	5.14	13.57	34.41
Percentage of total	69%	90%	81%	74%	98%	61%	81%	76%
NYSL								
Total words	34,922	67,952	604	511	10,096	59,268	68,590	241,943
Average	4.29	8.34	0.08	0.06	1.24	7.28	8.42	29.71
Total unique words	28,021	64,625	511	492	9,556	41,701	55,851	200,757
Average	3.44	7.94	0.06	0.06	1.17	5.12	6.86	24.65
Percentage of total words	80%	95%	85%	96%	95%	70%	81%	83%
PLCFC								
Total words	33,649	44,122	3,385	636	0	40,220	65,864	187,876
Average	3.46	4.54	0.35	0.06	0	4.14	6.78	19.33
Total unique words	30,225	41,128	3,107	620	0	29,339	61,175	165,594
Average	3.11	4.23	0.32	0.06	0	3.02	6.30	17.04
Percentage of total words	90%	93%	92%	97%	0	73%	93%	88%
UI								
Total words	25,378	44,228	5,675	13,134	1,765	67,527	66,733	222,440
Average	3.19	6.04	0.78	1.80	0.24	9.23	9.12	30.40
Total unique words	21,750	42,005	4,531	11,120	1,740	39,237	54,844	175,227
Average	2.97	5.74	0.62	1.52	0.24	5.36	7.50	23.95
Percentage of total words	93%	95%	80%	85%	99%	58%	82%	79%
Total								
Total words	198,949	246,033	21,129	40,001	15,112	267,011	399,106	1,187,341
Average	5.37	6.64	0.57	1.08	0.41	7.21	10.77	32.05
Total unique words	153,916	228,550	17,438	31,377	14,485	171,205	332,905	949,876
Average	4.15	6.17	0.47	0.85	0.39	4.62	8.99	25.64
Percentage of total words	77%	93%	83%	78%	96%	64%	83%	80%

Appendix P. Memo Briefing Decimal Classification Division Staff on Searching the Experimental Online Catalog

TO: Dewey Decimal Classification Division Staff

FROM: Karen Markey, Principal Investigator, DDC Online Project, OCLC

SUBJECT: Searching the Experimental Subject Online Catalogs

Background of the DDC Online Project

From May 7 to May 29, 1985, the experimental online catalogs developed by the OCLC Office of Research will be available to Dewey Decimal Classification Division staff for online searching in the Division Office. There are two experimental online catalogs which have been developed for the research project. The first experimental online catalog called SOC (or catalog A) has the traditional subject searching capabilities of online catalogs, namely, subject headings, and subject and title keyword searches; the second experimental online catalog called DOC (or Z) has both the traditional subject searching capabilities of SOC (or catalog A) and enhanced subject searching capabilities because the DDC Relative Index and DDC Schedules and notes have been integrated into this experimental catalog's subject searching capabilities.

In December 1984, February 1985, and April 1985, these experimental online catalogs were available to library patron and staff searchers at the University of Illinois mathematics library, Public Library of Columbus and Franklin County's humanities department, and Social Science Reading Room of the Library of Congress. The online catalogs featured databases containing each library's own bibliographic records in selected subject areas. The DDC Online Project Team conducted interviews and online searching tests with these three libraries' patrons and staff to find out patron and staff difficulties using these experimental online catalogs, suggestions for improving the catalogs, users' satisfaction with their online subject searches, and their catalog preference.

Purpose of Your Use of the Catalog

The purpose of making the experimental online catalogs available to Division staff is to find out how these catalogs help you to perform subject searches in connection with your classification and/or editorial tasks and your suggestions for improving the experimental online catalogs. I will return to the Library of Congress and Decimal Classification Division on May 29 and 30 to conduct group interviews with you (1 1/2 to 2 hours in length) to find out your reactions toward the experimental online catalogs.

Appendix P--Continued

Searching the Experimental Catalog

The database of the experimental online catalog covers the DDC areas 330-333, 336-339, 380-382, 650, and 658-659, i.e., Library of Congress books in economics, finance, industry, management, commerce, trade, and employment. During the period May 7 to May 28, I would like you to familiarize yourself with searching the experimental online catalog by performing subject searches in SOC and DOC in connection with your classification and/or editorial tasks or by completing subject searches for at least three of the twelve subject search topics listed below.

Subject Search Topics:

1. Financial planning for retirement
2. Economic development in the Soviet Union
3. Motivating employees
4. Stock options
5. Technology transfer to developing countries
6. Job hunting
7. American corporations in South Africa
8. Corporate mergers
9. Japanese style of management
10. Women executives
11. Food problems in third world countries, especially in Africa
12. Taxation of corporations

First, choose three of the twelve search topics listed above. Complete an online search for the topic in SOC (or catalog A). Then, complete an online search for the same topic in DOC (or catalog Z). Note that each catalog A and Z have a number of subject searching options, e.g., search alphabetically, search subject outline, search directly, and search for call number in catalog Z. As you perform your search, ask yourself the following questions:

1. What subject search option in SOC obtains the best results for this topic? In DOC?

2. Which catalog and subject search option and search results would be most helpful to me when classifying a book on this topic?

3. What SOC and DOC subject search capabilities are particularly suited to assisting me when performing classificatory or editorial tasks?

4. What classificatory or editorial tasks can be facilitated by searching SOC? By searching DOC?

5. What capabilities are SOC and DOC lacking that would facilitate my classificatory or editorial tasks? How would I improve SOC and DOC?

Appendix P--Continued

6. What changes need to be made to the DDC Relative Index and Schedules to enhance their potential as an online user's tool for subject access, browsing, and display in an online catalog for use by library patrons?

7. What changes need to be made to the DDC Relative Index and Schedules to enhance their potential as an online tool for classificatory tasks by library staff?

Think about these questions as you perform searches in SOC and DOC. Do as many searches as you want to familiarize yourself with experimental online catalog capabilities, but don't feel that you have to complete all three subject searches at one sitting. Feel free to perform subject searches on topics in which you are interested (within the scope of the catalog's limited database). Keep a notepad nearby the experimental online catalog to jot down your answers to these questions and other reactions to prepare for your group interview on May 29 or 30.

A Brief Guide to SOC and DOC Searching

Both SOC and DOC are easy to search. The catalogs are menu-based systems and always provide a list of options at the end of every system response which tell you the possible next actions in the search. Both systems also provide an initial screen which details the available subject search options and the system response. Reading this initial screen is mandatory; in fact, further instructions in the use of the catalogs are unnecessary. Yet, I have provided more detailed instructions below for those of you who are interested.

SOC Searching

SOC (or catalog A) has the traditional subject searching capabilities of online catalogs, namely, subject heading, and subject and title keyword searches. SOC's subject searching options are described below with respect to their functional description, sources of terms for indexing, and subsequent user actions.

SOC Option Code	Functional Description	Source of Subject Term for Indexing	Wisest Subsequent User Action(s)
SA	Search for subject and browse an alphabetical list of subjects near your subject	Assigned subject headings from the library's bibliographic records	Select a listed subject heading (SL option) to display retrieved items, or browse backward or forward (BB or BF option)

Appendix P--Continued

SOC Option Code	Functional Description	Source of Subject Term for Indexing	Wisest Subsequent User Action(s)
SD	Search directly for subject and retrieve number of items on your subject	Keyword, implicit Boolean AND search of title, subject, heading, series, and notes words in bibliographic records	Display retrieved items (DI option)
SC	Search directly for call number and retrieve number of items with your call number	Class numbers in 082a subfield of the library's bibliographic records	Display retrieved items (DI option)

DOC Searching

DOC (or catalog Z) has both the traditional subject searching capabilities of SOC and enhanced subject searching capabilities because the DDC Relative Index and DDC Schedules and notes have been integrated into DOC's subject searching capabilities. DOC's subject searching options are described below with respect to their functional description, sources of terms for indexing, and subsequent user actions.

SOC Option Code	Functional Description	Source of Subject Term for Indexing	Wisest Subsequent User Action(s)
SA	Search for subject and browse an alphabetical list of subjects near your subject	DDC Relative Index entries matching class numbers in the library's bibliographic records	Select a listed Relative Index entry to display retrieved items (SL option), or browse forward or backward in the alphabetical list (BF or BB option), or select a listed Relative Index entry to obtain a subject outline from the classification Schedules (ST option)

Appendix P--Continued

SOC Option Code	Functional Description	Source of Subject Term for Indexing	Wisest Subsequent User Action(s)
SS	Search for subject and browse an outline of subjects related to your subject	Keyword, implicit Boolean AND search of DDC Relative Index entries, DDC Schedules and notes, and the first subject heading listed in the library's bibliographic records directing users to outlines of DDC Schedule captions in the classification area(s) where there are records bearing user-entered terms	Select a listed DDC Schedule caption to display retrieved items (SL option), or browse more specific DDC Schedule captions (BS option)
SD	Search directly for subject and retrieve number of items on your subject	Keyword, implicit Boolean AND search of title, subject heading, series, note, DDC Relative Index entry, and DDC Schedule and note words in bibliographic records	Display retrieved items (DI option)
SC	Search for call number and browse an outline of meanings of call numbers	Class numbers in 082a subfield of bibliographic records directing users to outlines of DDC Schedule captions in the classification area matching user-entered call number	Select a listed DDC Schedule caption to display retrieved items (SL option), or browse more specific DDC captions (BS option)

Appendix P--Continued

If you are interested in technical descriptions of SOC and DOC searching capabilities, and indexing and display of MARC/LC record fields and subfields, copies of pages 6-18 of OCLC's Interim Report to the Council on Library Resources on the DDC Online Project dated February 1985 are available at the terminal of the experimental online catalog.

Many thanks for your interest in evaluating the experimental online catalogs of the DDC Online Project. I am looking forward to our group interviews in late May.

Appendix Q. Focused-Group Interview Questions

1. Classification
    a. How did you use DOC to classify a book on one of the topics you searched?
    Probes:
        (1) What DOC capabilities are particularly suited for carrying out classification tasks?
        (2) What DOC capabilities are unique to this system, i.e., unavailable through other printed or online tools, for classification tasks?
        (3) Using DOC, what have you found out about the practice of classification?
        (4) How would you improve DOC to help you classify books?
        Probes:
            (a) Searching capabilities (different options)
            (b) Browsing capabilities (different term lists: name)
            (c) Limiting capabilities
            (d) Display of
                - Schedules
                - Schedule notes
                - Relative Index
                - Bibliographic records

    b. How did you use MUMS, SCORPIO, or SOC to classify a book on one of the topics you searched?
    Probes:
        (1) What SOC capabilities are particularly suited for carrying out classification tasks?
        (2) How would you improve SOC to help you classify a book on one of the topics you searched?
        Probes:
            (a) Searching capabilities (different options)
            (b) Browsing capabilities (different term lists: name)
            (c) Limiting capabilities
            (d) Display of bibliographic records

2. Subject Searching

    a. Think back to the subject searches you performed in SOC and DOC. Tell us about your experiences.
        (1) What blind alleys or failures did you have using DOC?
        Probes:

Appendix Q--Continued

        (a) What do you think contributed to these failures?
        (b) Words not available in the Relative Index?
        (c) Words not available in the Schedules or notes?
    (2) What blind alleys or failures did you have using SOC?
        Probes:
        (a) What do you think contributed to these failures?
        (b) Words not available in subject headings?
        (c) Words not available in titles?

b. In what ways could DOC be improved to help users do better subject searches?
   Probes:
   (1) Searching capabilities (different options)
   (2) Browsing capabilities (different term lists: name)
   (3) Limiting capabilities
   (4) Display of
       (a) Schedules
       (b) Schedule notes
       (c) Relative Index
       (d) Bibliographic records
   (5) Content of
       (a) Schedules
       (b) Schedule notes
       (c) Relative Index
       (d) Bibliographic records

3. Editorial Work

a. What editorial tasks are facilitated by using DOC?
   Probes:
   (1) What DOC capabilities are particularly suited for assisting editorial work?
   (2) What DOC capabilities are unique to this system, i.e., unavailable through other printed or online tools, for editorial tasks?
   (3) Are DDC numbers being used in the ways in which they are intended?

4. Enhancement for Library Patrons

a. What changes may need to be made to the DDC to enhance its potential as an online tool for subject access, browsing, and display in an online catalog like DOC or MUMS or SCORPIO for use by library patrons?
   Probes:
   (1) Schedules: hierarchical structure, synthesis, specificity, captions, notes
   (2) Relative Index
   (3) Auxiliary tables
   (4) Synthesis (number building)

Appendix Q--Continued

b. How has DOC changed your perception of how the DDC should be maintained and revised to benefit library patrons who can access the DDC in an online catalog (like DOC or MUMS or SCORPIO)?

5. Enhancement for Library Staff

a. Would it make sense to add the DDC Schedules and Relative Index into a system like MUMS or SCORPIO so that you could search much the way you did on DOC whenever you wanted?

b. What changes may need to be made to the DDC to enhance its potential as an online MUMS or SCORPIO tool for subject access, browsing, and display for your use?

Probes:
(1) Schedules: hierarchical structure, synthesis, specificity, captions, notes
(2) Relative Index
(3) Auxiliary tables
(4) Synthesis (number building)

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